THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

VOL. IV.—1863-1865.

DUBLIN:
HODGES, SMITH, & CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, & CO. EDINBURGH: JOHN MENZIES.
1866.

DUBLIN:
Printed at the University Press,
BY M. H. GILL.

INDEX.

ADAMS, Dr. Andrew L., observations of, on fossil caves in Malta, 11.
—— description of plates of, 18, 19.
Agricultural Exhibition, distribution of prizes for, 74.
—— Museum, return of donations to, 138.
Albumen, observations on, by Mr. Reynolds, 249.
—— analysis of, 250.
—— action of heat on, in various states, 251.
—— method of obtaining, 249.
—— combination of, with silver, 254.
—— in combination, 253.
Analysis, spectrum; see Spectrum Analysis.
Anderson, Mr. W., observations of, on Mr. Scott's paper, 48.
Andrews, Mr. Wm., on salmon fisheries of Ireland, 81, 112.
—— on the natural habits of salmon spawning, 83.
—— on salmon seasons, 86.
—— on stake nets and fixed engines, 92.
—— on sea fisheries of Ireland, with reference to trawling, 295.
—— on best grounds for trawling, 307.
—— discussions on paper of, 316.
Arctic discovery; see Mr. J. Locke.
Art, School of, names of students who obtained prizes in, 80, 287, 288, 481.
—— distribution of prizes to students of, 79, 284, 475.
Aurora borealis; see Mr. B. Haughton.

Baily, Mr. W. H., description of Plesiosaurus by, 160.
—— see Plesiosaurus.
Baldwin, Mr., observations of, on Mr. Gamgee's paper, 64.
—— observations of, on Mr. Lawe's paper, 277.
Barry, Dr. J. M., notes of, on recent visit to Australia, 290.
—— on Mr. Edmunds' system of ventilating ships, 423.
—— on icebergs, 431.
Barry, Mr. J. R., table of, relative to salmon fisheries, 112.
—— observations of, on Irish fisheries, 100.
Barometer; see Mr. Yeates.
Blake, Mr. J. A., observations of, on Irish fisheries, 98.
Bog, Dr. Ellis on reclamation of, 352.
Botanic Gardens, return of donations to, 70, 136, 172, 282, 472, 391.
Botanical tour, notes of, by Mr. Moore, 189.

Cameron, Dr. Charles, observations of, on Mr. Gamgee's paper, 63.
—— observations of, on Mr. Lawes' paper, 276.
—— on chemical composition and fertilizing value of sewage of Dublin, 397.
—— discussions on paper of, 415-417.
Carte, Dr. A., description of Plesiosaurus by, 160.
—— see Plesiosaurus.
Cattle, Irish, mortality amongst, 59.
Coal, Irish; see Mr. O'Hara.
—— mines of Ireland, return of situations of, 246, 249.
Condensed peat, Mr. Scott on the use of, in reducing iron, 43.
Crory, Mr. Wm. Glenny, on development of industrial resources of Ireland, 78.

Davy, Dr. E. W., on the practicability of extending the cultivation of flax in Ireland, 234.
—— see Flax.

Diet of Irish labourers, suggestions for improvement of, 285.
Disease of animals in Ireland; see Mr. Gamgee.
Distribution of prizes, observations of Lord Lieutenant at, 74.
Donations, return of, 67, 132, 170, 278, 467.
Donegal, mineral localities of; see Mr. R. Scott.
Drainage, arterial, suggestions of Mr. Joynt on, 358, 385.
—— state of law relative to 363.
—— list of districts of, 366.
—— letters from Sir R. Peel and Sir Thomas Larcom, relative to, 373, 374.
—— see Mr. Joynt.
—— observations of Sir R. Peel on, 380.
—— observations of Mr. Maunsell on, 383.
—— observations of Mr. N. H. Dyas on, 379.
—— various discussions on Mr. Joynt's paper, 379.
Dyas, Mr. N. H., observations of, relative to arterial drainage, 379.

Edmunds, Dr., Dr. Barry on system of, for ventilating ships, 423.
Ellis, Dr. George, hints on reclamation of bog by, 352.
Epizootic disorders; see Mr. Gamgee.

Feeding of animals, observations on chemistry of, by Mr. Lawes, 256.
Ferguson, Mr. Hugh, observations of, relative to Mr. Gamgee's paper, 65.
Fine Arts, returns of donations to, 138, 174.
Fish, spawning periods of, 319.
Fisheries of Ireland, observations of Mr. Andrews on, 295.
Fishery Commission; see Mr. Barry.
Flax, on cultivation of in Ireland, by Dr. Davy, 324.
—— early history of, 325.
—— botanical relations of, 330.
—— introduction of, into Ireland, 327.
—— soils adapted for growth of, 331.
—— rotation of crop of, 333.
—— chemistry of, 334.
—— advantages of extending cultivation of, 338.
—— directions for management of crop of, 340.
—— progress of crop of, 342.
—— rippling of, 344.
Flax, structure of stem of, 345.
—— steeping of, 346.
—— drying of, 349.
—— scutching of, 350.
—— Courtrai system of managing, 350.
Foyle fisheries; see Mr. Reeves.
Fuel in Ireland, observations on supply of, by Mr. O'Hara, 225.
—— obstacles to complete introduction of peat as, 227.
Gamgee, Mr. John, observations of, on prevalence of diseases amongst domestic animals in Ireland, 49, 66.
—— on epizootic disorders, 50.
—— suggestions of, as to remedies, 61.
—— discussions on paper of, 62.
—— on enzootic diseases, 55.
Ganly, Mr. J., observations of, on Mr. Gamgee's paper, 62.
Giesecke, Mr. Charles, on mineral localities of Donegal, 114.
—— see Mr. Scott.
Good, Mr. T., observations of, relative to Mr. Andrews' paper on trawling, 316.
Greer, Mr. J. J., on new patent ventilator, 78.

Hamilton, Mr. C. W., observations of, on Mr. Gamgee's paper, 63.
Haughton, Mr. Benjamin, on curious aurora borealis, 151.
—— Mr. James, observations of, on Mr. Gamgee's paper, 63.
—— on vegetarianism, 393.
Haughton, Professor, observations of, on Irish fisheries, 97.
Henry, Captain R. J., observations of, relative to Dr. Mapother's paper, with "mess table" affixed, 215.

Icebergs; see Dr. Barry.
Intelligence, 74, 139, 175, 284, 393, 475.
Ireland, Mr. O'Hara on supply of fuel in, 225.
—— sea fisheries of; see Mr. Andrews.
Irish salmon fisheries; see Mr. Andrews.
—— see Mr. Reeves.
Iron, observations on reduction of, by Mr. Scott, 43.

Joynt, Alderman, observations of, relative to Irish fisheries, 99.
Joynt, Mr. L., on arterial Drainage Laws, 358, 385.
—— see Drainage.

Kennedy, Dr., on the neglect of sanitary arrangements, 446.
—— on sewerage, 447.
—— on contamination of pumps and wells, 449.
—— on contagion, 451.
—— on ventilation, 452, 456.
—— on heat, 458.
—— on grates and stoves, 459.
—— on clothes, 463.
—— on results of attention to sanitary improvements, 465.
Kettlehouse works, rough section of, 161.

Lawes, Mr. J. B., on chemistry of feeding of animals for the production of meat and manure, 256.
—— on proportions of stomachs of different animals, 273.
—— on comparative feeding value of different foods, 266.
—— on connexion between manure and food used, 270.
—— on appropriateness of animal food for man, 272.
—— analytical tables of, 258, 259, 261, 265, 270.
—— summary of conclusions of, 265–270.
—— various discussions on paper of, 276.
Lawson, Dr. H.; see *Limax maximus.*
Library, return of donations to, 67, 132, 170, 278, 387, 467.
Limax maximus, general anatomy of, 19.
—— tegumentary system of, 20.
—— muscular do., 21.
—— digestive do., 22.
—— respiratory do., 27.
—— circulatory do., 27.
—— nervous do., 31.
—— organs of hearing and touch of, 34.
—— taste and vision of, 35.
—— reproductive organs of, 36.
—— explanation of plates of, 42.
Locke, Mr. J., on arctic discovery, 419.
—— on remarkable discoveries in Central Australia, by J. M'Dougall Stewart, 141.

Malta, observations of fossiliferous caves of, by Dr. A. S. Adams, 11.
Manure, Mr. Waller on chemical value of, 440.
Mapother, Dr. E. D., observations of, on preparation of meat, 153.
Mapother, Dr. E. D., on modes of slaughtering animals, 158.
—— suggestions of, for improving the diet of Irish labourers, 205.
—— table of, on nutritive value of food, 210.
—— on present modes of slaughtering animals, 153.
—— on new method of slaughtering animals, 158.
—— on nutritive tribe of plants, 212.
—— discussions on paper of, 215-218.
Maunsell, Mr. G. W., observations of, relative to arterial Drainage Laws, 383.
Meat, Dr. Mapother on preparation of, 153.
Meat and manure; see Mr. Lawes.
Meteorological tables; see Appendix.
Methylic alcohol; see Mr. Reynolds.
Milk, quality of, supplied in Dublin; see Mr. Wonfor; see Mr. Pontifex.
Minerals, catalogue of those found in Donegal, 104, 125.
"Mouquin-Tandon;" see Dr. Lawson; see *Limax maximus.*
Moore, Mr. D., notes on botanical tour, 189.
Murrall, Mr. George, letter from, relative to reductions of iron by compressed peat, 46.

Natural History Museum; see Museum.

O'Hara, Mr. H., on the supply of fuel in Ireland, 225.
—— on coal found in Ireland, 230.
—— summary of conclusions of, 245.
—— tables of, of several coalfields in Ireland, 246–249.

Peel, Sir R., observations of, relative to arterial Drainage Laws, 380.
Peat, compressed; see Mr. Scott.
—— method of preparing, 45.
—— Mr. Murrall on use of, for smelting iron, 46.
Plates, description of, 18, 19, 42, 43, 170.
Plesiosaurus, description of new species of, by Dr. Carte and Mr. Baily, 161.
—— description of orbits of, 163.
—— lower jaw of, 164.
—— teeth of, 165.
—— cervical region of, 165.
—— dorsal, caudal, costal regions of, 167.

Plesiosaurus, description of pectoral extremity of, 167.
—— table of comparative measurements of, 169.
—— number of vertebræ of, 170.
—— explanation of plates of, 170.
Pontifex, Mr. Sidney R., paper of, on quality of milk, 1.
—— analysis of various specimens of milk by, 4–10.
Purcell, Mr. Theobald, observations of, on Irish fisheries, 99–111.

Reeves, Mr. Robert Wm., observations of, on Irish salmon fisheries, 101.
—— tables of, relative to Foyle fisheries, 102, 103.
—— discussions on paper of, 111-113.
—— see Mr. Barry.
Reilly, Edward, deposition of, relative to trawling, 323.
Reynolds, Mr. Emerson, observations of, on wood spirit and its detection, 126.
—— notes of, on pure methylic alcohol, 131.
—— experiments of, with mercurial solution, 128.
—— on spectrum analysis, 218.
—— on different modes of obtaining spectra, 220.
—— on nomenclature of lines of spectrum, 221.
—— on presence of Thallium in Irish minerals, 220.
—— on albumen and its combinations, 249.
—— on spectrum apparatus, 218.
—— on application of spectrum, 221.

Salmon fisheries of Ireland; see Mr. Andrews.
—— laws relative to, 90.
—— see Mr. Reeves.
Sanitary arrangements, Dr. Kennedy on the neglect of, 446.
—— see Dr. Kennedy.
Scandinavia, Germany, and Belgium, notes of botanical tour, by Mr. Moore, 189.
Scott, Mr. R., on the reduction of iron by compressed peat, 43.
—— various discussions on paper of, 48.
Scott, Mr. R. D., on the mineral localities of Donegal, 114.
—— catalogue of minerals, by, 114–125.
—— mineralogical tables of, 122–125.
Sewerage, Mr. Cameron on chemical composition and fertilizing value of, 397.
—— sanitary aspects of, 398–413.
—— fertilizing properties of, 401.
—— crop suitable for, 405.
—— value of, 407.
Spectrum, analysis, notes on, by Mr. E. Reynolds, 218.
—— application of, to the examination of minerals, 221.
Stewart, Mr. J. M'Douall, third paper on discoveries of, in Central Australia, 141.
—— see Mr. Locke.

Talbot, Lord, de Malahide, observations of, on Mr. Gamgee's paper, 62.
Trawling, Mr. Andrews on fisheries with reference to, 295.
—— various opinions on, 201.
—— best ground for, 307.
—— class of boats required for, 309.
—— fish taken by, 319.
—— fitting out of vessels for, 322.
—— deposition of Edward Reilly relative to, 323.

Vegetarianism, Mr. Haughton on advantages of, 393.
Vereker, Hon. J. P., observations of, on Mr. Gamgee's paper, 62.

Waller, Mr. George, on value of manure of Waterford Harbour, 440.
Waterford Harbour; see Mr. Waller.
Weirs, salmon, observations of Mr. Andrews respecting, 92.
Wonfor, Mr. William, paper of, on quality of milk supplied in Dublin, 1.
—— analysis of various specimens of milk, 4-10.
Wood Spirit, and its detection; see Mr. E. Reynolds.

Yeates, Mr., on new table for determining altitudes with the barometer, 444.

Nos. XXVI. XXVII. XXVIII.] JULY to JANUARY. [Price 2s.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

Published Quarterly.

CONTENTS:

		PAGE.
1.	MESSRS. WONFOR and PONTIFEX on the Milk supplied in Dublin,	1
2.	DR. ADAMS on the Fossiliferous Caves of Malta,	11
3.	DR. LAWSON on the Anatomy, Histology, and Physiology of *Limax maximus* (Moquin-Tandon),	19
4.	MR. SCOTT on the Reduction of Iron by the Use of Condensed Peat,	43
5.	MR. GAMGEE on the Prevalence and Prevention of Diseases amongst our Domestic Animals,	49
6.	Return of Donations to the Royal Dublin Society,	67
7.	Intelligence,	74
	APPENDIX.—Meteorological Journal for the Months of January, February, March, April, May, June, July, August, September, October, and November, 1862,	i

DUBLIN:
HODGES, SMITH, AND CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.
1863.

M. H. GILL, Printer to the Royal Dublin Society.

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

The Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Registrar:—

Life Membership, ...£21 0 0
Annual Membership (with £3 3*s.* Entrance Fee), 2 2 0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15*s.*

I.—Meetings of the Society.

1. *Stated and Ordinary Meetings.*

The Society meets at 2 o'Clock P. M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday in November.

2. *Evening Scientific Meetings.*

Meetings of the Society and of the Associated Societies, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session. The business is conducted in the following sections:—

I. Agriculture and Rural Economy, and Horticulture.
II. Fine Arts.
III. Natural Sciences, including Zoology, Botany, Physiology, Mineralogy, Geology, Physical and Descriptive Geography.
IV. Experimental Sciences, including Physics, Chemistry, Physiology, Meteorology, and the Mechanical Arts.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society, and in the Quarterly Journal of Science.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5*s.* to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6*d.* each; or to twelve for 5*s.*, available for any of the ordinary Meetings throughout the Session.

The Council and Committees.

The Council, which comes into office in January, meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

Eight Standing Committees are annually elected, as follows:—1. Agriculture; 2. Botany; 3. Chemistry; 4. Fine Arts; 5. Library; 6. Manufactures; 7. Natural History; 8. Natural Philosophy. Besides these are the Evening Meetings Committee and Sectional and occasional Committees.

II.—Departments of the Society.

1. *Agriculture.*

a. The Annual Spring Show of Cattle, Poultry, and Implements, is held on Tuesday in Easter Week.

b. The Christmas Show of Fat Stock and Farm and Dairy Produce is held in the Third Week of December.

c. Chemical Analyses of Agricultural Produce, Soils, Manures, &c., are performed in the Laboratory, under the superintendence of the Professor of Agriculture, according to a fixed scale of moderate charges.

d. The Agricultural Museum open daily (Sundays excepted) from 11 to o'Clock.

[*For continuation, see page* 3 *of Cover.*

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

JULY TO JANUARY, 1863.

I.—*On the Quality of the Milk supplied to the Poor and other Districts of Dublin.* By William J. Wonfor, and Sidney R. Pontifex, Students in the Laboratory of the Museum of Irish Industry.

[Read on Monday Evening, April 14, 1862.]

The great attention which is now given to social questions is one of the characteristics of the age; and one of the most important of these questions is the sanitary condition of the people. The chief causes which tend to injure health and shorten life are foul air, foul water, and adulterated food.

As milk forms so large a portion of the diet of young children, it becomes one of the most important of all the substances used as food. It is, therefore, a matter of great importance to know in what state it is sold to the public, more especially to the poor.

The examination of the milk supplied to the London public was made, some time ago, by the Analytical Sanitary Commissioners of the "Lancet." We thought it would not be less interesting or important to know the quality of the milk supplied to the citizens of Dublin; we therefore examined twenty samples, from as many different dairies; these samples we either purchased ourselves, or obtained through trusted friends. We were chiefly desirous of knowing the quality of the milk supplied in the poor districts; but as milk has no definite composition, as its quality can be greatly altered by the kind and quality of the food upon which the cows are fed, we analysed some of the milks sold in the more wealthy districts; in order to ascertain whether the poor were worse served than their more affluent neighbours. The only substance we have found added to the milk is water; this may be done either in-

directly by the partial removal of the cream, or directly by the addition of a certain quantity of water. Although milk has no definite constitution, the numerous analyses of pure milk, made by different chemists, show that the quantity of water and the total quantity of solid matter in milk from cows properly fed is pretty uniform, whilst the relative proportions of the substances forming the solid matter is subject to great variations. The average quantity of water in 8 samples of milk, analysed by Boussingault, gave 87·4 per cent.; in 9 analyses of milk, published by Dr. Lyon Playfair, the average quantity of water was 86·5; and in 11 analyses of milk, analysed by Mr. Plunkett,* the assistant chemist in the Museum of Irish Industry, the average quantity of water was 87·9; from the average of all the analyses of pure milk we could meet with, we found the quantity of water to be 87·35. Now, the average quantity of water in the 13 milks examined by us from the poor districts is 90·28, and the average quantity in the 7 samples from the better districts is 89·4.

On account of milk having no definite constitution, the fairest plan appears to be, in comparing each individual sample of milk examined by us with pure milk, to take as the standard, not the average of all the analyses of pure milk, but the sample of pure milk which contains the largest portion of water. Now, the largest quantity of water we have met with is 88·363 per cent., one of the milks analysed by Mr. Plunkett; this milk, therefore, contained 11·637 per cent. of solid matter. We at first regarded any increase of water over the quantity contained in the standard milk as so much water added; this would only give a slight addition of water in any of the milks examined; we afterwards perceived that this was not the correct way to do it, but that each per cent. increase of water ought to be viewed as the decrease of so much solid matter—this makes the addition of water much *greater*. For, taking 11·637, or for sake of simplifying the calculation 11·5, as the smallest quantity of solid matter in pure milk, each per cent. decrease on this amount is equivalent to the removal of 8·7 per cent. of milk, and its replacement by a similar quantity of water. The amount of solid matter, and not the water, becomes the key to the extent of the adulteration. In the milks we examined, it will be at once seen, on adding the ash and the total amount of organic matter together, whether the milk had been adulterated or not; and, if it had, to what extent the adulteration had been carried. To take as an example the worst milk we have examined, viz. that from Townsend-street, it will be seen on referring to the analysis that it contains 6·45 per cent. of organic matter, and 0·62 per cent. of ash; it contains, therefore, 7·07 per cent. of solid matter; 39 per cent. of milk has therefore been removed, and an equal quantity of water has been added.

* We are under great obligations to Mr. Plunkett for allowing us to make use of his yet unpublished researches.

The normal constituents of milk are water, a small quantity of mineral matter (ash), casein, sugar, and butter; albumen is only a constituent in the colostrum, or first milkings after parturition; we found it present in three of the milks; but we only made a separate estimation in one of them.

The estimation of the different substances was made in the following way:—

We first tested the reaction of the milk with very delicate test-papers. We do not attach much importance to this point, but did it merely to determine the state of the milk at the commencement of the analysis. The specific gravity was determined by direct weighing, at 60° Fah.

To determine the water, total organic matter, and ash, a weighed portion of the milk was evaporated to dryness in a porcelain crucible; the residue dried in a water-bath, at 212° Fah., and weighed; the residue, subtracted from the quantity originally employed, gave the amount of water. It was then incinerated until all the carbonaceous matter was burnt off, and a white, or rather a grey-tinted, ash remained; the weight of this ash, deducted from the total amount of residue, gave the quantity of organic constituents.

The organic matter is, as before stated, composed of three, or sometimes four, different substances; the estimation of these require two separate portions of milk.

To a portion intended for the estimation of the butter is added one-fourth of its weight of powdered unburnt gypsum; the mixture is evaporated over a water-bath, with frequent stirring, to insure uniform admixture; the action of gypsum, when aided by heat, is to coagulate the casein, and, when dry, we obtain a mass easily powdered. We found the process facilitated by allowing the milk first to get hot, and then adding the gypsum; the casein is immediately coagulated. The residue, when dry, is powdered, treated in a small flask with successive portions of ether, each of which is allowed to digest for some time, and then filtered into another dried flask of known weight; when all the butter is removed—this can easily be ascertained by evaporating a few drops of the filtrate to dryness; if no greasy residue remain, it may be concluded that the operation is finished—the ether is distilled off, and the flask and contents dried in the water-bath, until it ceases to lose weight; the difference between the weights of the flask when empty, and when containing the butter, gives the amount of butter in the quantity of milk employed.

The sugar and casein are separated from the same portion by the following process:—To a weighed quantity of the milk is added one-sixth of its weight of acetic acid, and the precipitate collected, and carefully washed with *cold* water, on a filter which has been previously dried in the water-bath at 212° Fah., and weighed in a stoppered tube; the butter in the milk is enclosed and carried down by the casein, when the latter is coagulated by the acid, and therefore the two substances

remain on the filter; they are dried together under the same circumstances as the filter alone, and weighed. Deducting the weight of butter in 100 parts of milk from the weight of butter and casein in a similar quantity, we obtain the per-centage of casein.

The filtrate and washings from the acetic acid precipitate are collected together, and used for the determination of the sugar, which was estimated by Fehling's method.

It has already been stated that albumen occurs in milk only under certain circumstances; we have found it present in a few; the estimation of it is easily effected in the following manner:—To the filtrate from the acetic acid precipitate is added twice its volume of alcohol, and the solution heated to about 100° Fah.; the albumen readily separates as a flocculent precipitate, and is collected on a filter, washed, dried, and weighed in a tube, in a similar manner to the method pursued in the estimation of the casein, the filtrate being used for the determination of the sugar.

We now give the first and second analyses, and mean results of the various samples:—

I. Honor Moore, 1, Duke-lane. Morning Milk; 4*d*. per quart.

	I.	II.	MEAN.
Specific gravity, ...	1032·4	1032·35	1032·37
Total amount of organic matter,	11·206	11·80	11·503
Water, ...	87·974	87·35	87·662
Butter, ...	2·900	2·71	2·773
Sugar, ...	5·550	9·09	5·500
Casein and Albumen, . . .	2·756		2·756
Ash, ...	·820	·85	·835
	100·000	100·00	99·486

II. —— Farrell, Sandwith-place. Morning Milk; supplied to Hanover-quay; 3*d*. per quart.

	I.	II.	MEAN.
Specific gravity, ...	1020·86	1020·8	1020·83
Total amount of organic matter,	6·839	6·865	6·847
Water, ...	92·640	92·700	92·670
Butter, ...	1·600	1·600	1·600
Sugar, ...	3·156	3·160	3·158
Casein, ...	2·074	1·700	1·887
Ash, ...	·530	·435	·482
	100·000	99·595	99·797

III. Patrick Lennon, 36, Lower Kevin-street. Morning Milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1023·515	1023·553	1023·34
Total amount of organic matter,	8·734	8·725	8·73
Water, ...	90·740	90·750	90·745
Butter, ...	2·453	2·520	2·486
Sugar, ...	4·210	4·276	4·243
Casein, ...	2·071	1·909	1·991
Ash, ...	·526	·525	·525
	100·000	99·980	99·990

IV. George Phipps, 73½ Bride-st. Morning Milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1022·96	1023·6	1023·28
Total amount of organic matter,	7·957	7·885	7·921
Water, ...	91·400	91·500	91·450
Butter, ...	2·290	2·280	2·285
Sugar, ...	3·400	3·236	3·318
Casein, ...	2·090	2·330	2·210
Ash, ...	·643	·615	·629
	99·823	99·961	99·892

V. Brien Fegan, Church-avenue, Rathmines. Morning Milk; supplied to Anne-street; 4*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1030·105	1030·037	1030·71
Total amount of organic matter,	11·180	11·275	11·225
Water, ...	88·170	88·05	88·11
Butter, ...	3·020	3·20	3·11
Sugar, ...	5·300	5·10	5·30
Casein, ...	2·950	2·87	2·91
Ash, ...	·650	·675	·665
	100·090	99·895	99·995

VI. M. Lynham, 67, Pill-lane. Evening Milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1020·00	1019·87	1019·93
Total amount of organic matter,	10·12	10·14	10·13
Water, ...	89·280	89·20	89·24
Butter, ...	4·880	4·92	4·90
Sugar, ...	3·310	3·23	3·27
Casein, ...	2·015	1·92	1·967
Ash, ...	·600	·65	·62
	100·085	99·92	99·997

This milk contains a very high proportion of butter; it had probably been standing some time, and the cream partly risen to the surface.

VII. John Tyrrell, 128, Townsend-street. Evening milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1018·81	1018·36	1018·58
Total amount of organic matter,	6·427	6·48	6·453
Water, ...	93·000	92·90	92·95
Butter, ...	2·180	2·20	2·19
Sugar, ...	2·410	2·39	2·40
Casein, ...	1·710	1·74	1·725
Ash, ...	·573	·68	·625
	99·873	99·91	99·890

VIII. —— Murphy, 54, Francis-street. Morning milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1023·6	1023·532	1023·56
Total amount of organic matter,	7·607	7·500	7·553
Water, ...	91·807	91·865	91·836
Butter, ...	2·000	2·100	2·050
Sugar, ...	3·310	3·236	3·273
Casein, ...	2·127	2·107	2·117
Ash, ...	·586	·635	·610
	99·830	99·943	99·886

IX. —— Neill, Cullenswood. Supplied to Harrington-street. Morning milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1027·5	1027·45	1027·47
Total amount of organic matter,	9·713	9·66	9·686
Water, ...	89·714	89·765	89·739
Butter, ...	2·920	2·860	2·890
Sugar, ...	3·400	3·495	3·447
Casein, ...	2·303	2·370	2·336
Ash, ...	·573	·580	·576
	98·910	99·070	98·988

X. —— Toole, 24, Charles-street. Morning milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1023·72	1023·69	1023·7
Total amount of organic matter,	—	7·70	7·7
Water, ...	91·700	91·70	91·700
Butter, ...	2·330	2·40	2·365
Sugar, ...	3·316	3.236	3·271
Casein, ...	2·011	1·960	1·985
Ash, ...	·600	·600	·600
	99·957	99·896	99·921

XI. —— Campbell, Windy Harbour, Milltown. Morning milk, supplied to Cullenswood-avenue; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1025·300	1025·400	1025·35
Total amount of organic matter,	8·934	9·075	9·004
Water, ...	90·320	90·360	90·34
Butter, ...	2·225	2·200	2·217
Sugar, ...	4·060	4·279	4·170
Casein and albumen, . . .	2·695	2·570	2·632
Ash, ...	·746	·565	·655
	100·046	99·974	100·014

XII. —— Brennan, Ranelagh. Morning milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1027·00	1026·90	1026·95
Total amount of organic matter,	9·03	8·99	9·01
Water, ...	90·340	90·36	90·35
Butter, ...	2·385	—	2·385
Sugar, ...	2·891	2·884	2·887
Casein, ...	3·585	Casein & Butter. } 6·003	3·601
Ash, ...	·630	·650	·640
	99·831	99·897	99·863

XIII. —— Finnigan, 18, Great Britain-street. Morning milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1026·980	1027·000	1026·99
Total amount of organic matter,	9·363	9·705	9·534
Water, ...	90·034	89·700	89·867
Butter, ...	2·980	3·020	3·000
Sugar, ...	2·653	2·655	2·654
Casein, ...	3·246	3·446	3·346
Ash, ...	·603	·595	·599
	99·516	99·416	99·466

XIV. —— Brady, North Clarence-street. Morning milk; supplied to the North Strand; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1029·68	1029·73	1029·71
Total amount of organic matter,	9·834	9·62	9·727
Water, ...	89·500	89·700	89·600
Butter, ...	2·830	2·750	2·790
Sugar, ...	4·230	4·483	4·356
Casein, ...	2·743	2·221	2·483
Ash, ...	·666	·680	·670
	99·969	99·834	99·899

XV. —— Fitzsimons, North King-street. Morning milk; 3*d*. per quart.

	I.	II.	MEAN.
Specific gravity, ...	1031·95	1032·1	1032·025
Total amount of organic matter,	8·713	8·84	8·776
Water, ...	90·887	90·70	90·793
Butter, ...	3·440	—	3·440
Sugar, ...	4·010	3·79	3·900
Casein, ...	1·263	Casein & Butter, } 5·16	1·263
Ash, ...	·400	·46	·43
	100·000	100·11	99·826

XVI. —— Phillips, Brabazon-street. Evening milk; 3*d*. per quart.

	I.	II.	MEAN.
Specific gravity, ...	1023·44	1023·5	1023·47
Total amount of organic matter,	9·017	8·985	9·001
Water, ...	90·357	90·450	90·403
Butter, ...	3·200	3·070	3·135
Sugar, ...	2·823	3·160	2·991
Casein, ...	2·994	2·662	2·828
Ash, ...	·626	·565	·596
	100·000	99·907	99·950

XVII. J. Dunne, 172, Church-street. Milk; 3*d*. per quart.

Specific gravity, ...	1023·745
Total amount of organic matter,	7·425
Water, ...	91·875
Butter, ...	1·950
Sugar, ...	3·402
Casein, ...	2·013
Ash, ...	·700
	99·940

XVIII. —— Higgins, Mountpleasant-avenue. Evening milk, supplied to Rathmines-road.

	I.	II.	MEAN.
Specific gravity, ...	1028·5	1028·75	1028·625
Total amount of organic matter,	9·4	9·15	9·275
Water, ...	89·96	90·05	90·005
Butter, ...	2·68	2·71	2·695
Sugar, ...	3·79	3·79	3·790
Casein, ...	1·746	{ 2·658	1·591
Albumen, ...	1·222		1·222
Ash, ...	·640	·800	·720
	100·038	100·008	100·023

XIX. Pat. Monks, 24, Sheriff-street. Evening milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1029·58	1029·6	1029.59
Total amount of organic matter,	11·69	11·695	11·692
Water, ...	87·63	87·55	87·59
Butter, ...	4·78	Butter & Casein. } 6·25	4·78
Sugar, ...	5·528	5·31	5·419
Casein and Albumen, . . .	1·346	—	1·408
Ash, ...	·680	·755	·717
	99·964	99·865	92·914

XX. Mrs. Smith, 55, Barrack-street. Morning milk; 3*d.* per quart.

	I.	II.	MEAN.
Specific gravity, ...	1023·02	1023·089	1023·054
Total amount of organic matter,	7·20	7.370	7·285
Water, ...	92·14	92·155	92·147
Butter, ...	1·835	1·800	1·817
Sugar, ...	2·766	2·606	2·686
Casein, ...	2·341	2·764	2·552
Ash, ...	·660	·475	·567
	99·742	99·800	99·769

We have stated that the principal object of this investigation was to determine whether the poor were worse supplied than the richer classes;

it is, therefore, very pleasant to be enabled to state they are not; for Rathmines receives quite as bad milk as Brabazon-street or Great Britain-street; and the best of all is obtained from Sheriff-street, in the heart of a decidedly poor district.

All the analyses connected with this investigation were conducted in the Laboratory of the Museum of Irish Industry, under the direction of Professor Galloway.

II.—*Observations on the Fossiliferous Caves of Malta.* By Andrew Leith Adams, M. B., Surgeon, 22nd Regt.

(Plates I., II.)

[Read Monday Evening, November 18, 1861.]

The coast scenery of Malta varies greatly; on the N. E. the sandstone beds have been worn away nearly level with the sea; while on the south they have entirely disappeared, and the subjacent limestone rises into bold precipitous cliffs, several hundred feet in height. In this latter situation the geologist is struck by the appearance and position of the strata, especially that of the limestone. After he has traced the sandstone formations from Valetta harbour to the easternmost point of the island, over a curiously indented coast line, flat, and little raised above the sea, or jutting out into high weather-worn points and headlands, he suddenly finds himself on a compact limestone, which, after fringing the coast for miles, is again submerged, and covered by sandstone. The height attained by the former, on the southern side of Malta, varies much; opposite the islet of Filfla, it rises to an elevation of fully 300 feet above the sea; and, although shattered and worn by the action of the surf, has evidently withstood the eroding force of the elements better than the sandstone, as its ancient caverns and remnants of sea-beaches testify; whereas these interesting memorials in the softer rocks have long since been obliterated.*

The compactness and durability of the lower limestone varies considerably; sometimes it is semi-crystalline, of dense structure, and cream-coloured; and in consequence of the minute particles of shells and corals which enter largely into its composition, it has often a gritty appearance, very like the coarse sort of oatmeal.

In a quarry of this rock, during 1858, the chief subject of the present memoir was discovered.

---

* Earthquakes have contributed much towards the down-throw of the Maltese coast. About four years since, a severe shock loosened enormous projections; and even after the mild earthquake of last February (1861), I saw near Dingli, on the south side, large masses which had fallen down on that occasion, and many fresh cracks and fissures along the edges of the precipices.

The Maghlak cave was situated on the side of a terrace-cliff, about 300 feet above the present sea-level; its position was about S. W. of the town of Crendi, and directly opposite the islet Filfla, mentioned above.

Remnants of ancient beaches are traceable at broken intervals along the southern, as well as other portions of the coast; they are easily recognised by the water-worn appearance of their sides, and of the caves and fissures. One of the largest and most characteristic is Ghar Hassan's Cave.

It is to be regretted that no geologist explored the Maghlak cave, until long after its discovery, when every particle of the contents had been cleared out, and the outline entirely destroyed. Such was its condition three years afterwards, when I commenced my explorations; and eighteen months previously, Captain Spratt, R. N., found it in much the same state. There was, therefore, considerable difficulty at first in making out the relation of the various deposits; but after a careful examination of great portions of the remains on the side of the cliff, and in public and private collections, together with the evidence of the quarrymen, the connexion became clear and indisputable.

From what has been stated, it is to be understood, that the description of the outline and general appearance of the Maghlak cave was obtained from the quarrymen. They said:—"while blasting the rock, about twelve feet below the surface, they suddenly broke into the roof of two caverns; *these caves had* NO *communication with each other*. One contained a quantity of water, and no organic remains; whilst the other was thickly covered with incrustations of calcareous matter; the outline of both resembled an oven in shape (i. e., hemispherical); the diameter of the fossiliferous grotto was about six feet, and its height, four; it was for the greater part filled with deposits. There was a small external aperture, which looked towards the islet of Filfla, and was all but blocked up by incrustations (stalactites)."

The quarrymen computed the entire thickness of the fossiliferous deposit and stalagmite on the floor at *nearly six feet*. The latter assertion is in keeping with my examination of sections and portions of the remains. They further stated, "that among quantities of bones and teeth at the bottom of the cavern, were found several long bones of very large size; also an entire skull, with large crooked and straight tusks," doubtless belonging to the hippopotamus. This valuable relic broke to pieces during their attempts to remove it.

The Maghlak cave* was small compared with Ghar Hassan, in the neighbourhood, but there were evidences to show that what appeared to be an entire cave was only the extremity of a much larger opening in the rock. Captain Spratt was enabled to discover evidences of its extension much farther outwards by tracing the fossiliferous deposit

* Vide section of Maghlak cave.

for some distance along the terrace. The Maghlak must, therefore, be considered a fragment or extremity of what had doubtless been a large cave.

Observations showed that its vault and sides were thickly incrusted with stalactite and calc spar; the latter was of a yellowish-brown colour, and tinged with oxide of iron; the thickness of the calc spar must have been considerable, as several masses on the side of the cliff measured from $1\frac{1}{2}$ to 2 feet. The more superficial stalagmite on the floor contained no organic remains, at least none have been discovered to my knowledge; it gradually became looser in texture, and passed into a calcareous grey earth, more or less tinged with iron, and mixed with nodules and masses of a dark brown loam. In some situations the stalagmite resolved itself into a compact reddish limestone. Both of the last-named varieties contained abundance of land shells belonging to the genera helix and clausilia; there were but few remains of rodents; but several fragments of the long bones of large birds were found with those of the quadruped. The organic remains were most plentiful in the deeper portions, and grey-coloured deposit, where there were evident lines of stratification. In some situations teeth and bones of the rodents were so abundant, that I counted upwards of twenty incisor teeth on a surface of not more than one foot in circumference. Complete casts of helix, and of clausilia, were plentiful; the fragments of birds were numerous, especially their long and slender wing-bones; an entire scapula of a bird, of about the size of the woodcock, was found. Several masses of this deposit, showing its connexion with the surface and subjacent formations, gave a thickness of from two to three feet. I particularly noted in every instance where its connexion with the lowermost deposit existed, that for upwards of a foot immediately over the latter there was no trace of organic remains, as if a long interval had elapsed between the deposition of the rodent and the hippopotamus to be described.*

---

* *Discovery of the Remains of another Fossiliferous Cave in Malta.*—Another of these interesting relics of a pre-human epoch was brought to light last week through the researches of Captain Spratt, R. N., whose scientific labours in connexion with the geology of these islands are so well known and appreciated. Vague rumours prevailed some years ago of the existence of a cave of this kind at Meliha, which coming to the hearing of the late lamented Sir W. Reid, he directed the attention of Lord Ducie and Captain Spratt to the spot; but nothing then could be found. A fossil hippopotamus' tooth, in the possession of Signor Pace, an Italian gentleman, residing here, said to have been obtained from Meliha, led Captain Spratt to institute closer and stricter inquiries; and while in the Bay of Meliha with his ship, a few days ago, he succeeded in finding the remains of a fossiliferous cave at a short distance from the village church. It had been unfortunately almost destroyed to make way for a road, and the rubble used to fill up the interstices of a wall; but sufficient remains of hippopotamus' bones and teeth were dug up to indicate its having been of a similar character as the Meilach cave near Crendi, regarding which we lately published some interesting particulars from the pen of Dr. Leith Adams, 22nd Regt.—*Malta Times*, June, 1862

It is worthy of remark that in no part of the above formation were there observed any pebbles or fluviatile remains; the whole deposit did not differ materially in composition and appearance from what is now in course of formation in several caves and crevices along the coast.

The next and lowermost deposit in this cave was very different from the last. It consisted of a conglomerate of pebbles from the subjacent rock, bound together by a light brown or brick-red clay, nearly as indestructible as the pebbles themselves; the latter varied in size from that of a pea to one to two feet in circumference, and were much rounded and water-worn; from portions seemingly perpendicular sections of the deposit, its thickness may have been from two to three feet. Spreading through the conglomerate, and apparently the result of accident, were abundant remains of a species of hippopotamus; I say accident, from the fact, that there had been no regularity in the mode of the deposit; for teeth, tusks, and bones were embedded in the clay, and without any relative connexion, as if they had dropped from the jaws of a carnivore, or been flung pell-mell into the cave; so abundant were these remains, that from an inspection of what had been destroyed by the quarrymen, or carried away by visitors, the straight tusks of no less than eight hippopotamuses passed through my hands. A few teeth were chipped and worn on the crowns, as if they had been rolled. The bones were for the most part fragmentary, ragged, and splintered, with their cracks and fractures filled up with clay. Deciduous teeth were plentiful, chiefly conical-grooved pre-molars. I obtained a few lateral incisors, and two or three of the simple conical-crowned first pre-molars. Although canines and tusks of adults were abundant, those of younger individuals predominated. There seemed to be great variety, from the molar just appearing above the jaw, and tusks of a few inches in length, to old molars with broad crowns, and large trefoil-like markings. The tusks and canines were much worn and decayed, the latter especially, which were usually found in the form of conical fragments.

On comparing the remains from the Maghlak with descriptions of *Hipp. major* by Cuvier and later authorities, I find the same discrepancies with reference to size as are met with in the Sicilian specimens, and elsewhere along the shores of the Mediterranean,—thus furnishing additional proof that the hippopotamus of the south was either distinct, or belonged to a smaller race than that of the north of Europe.

A careful examination failed to discover even the trace of a carnivorous animal. Throughout the conglomerate there seemed no variety beyond the manifold remains of one species. The firmness with which they were embedded in the clay and among the limestone pebbles, the dimensions of the cavern, and the piecemeal nature of the relics, all tend to show that at least the animals could not have died where their remains were found.

Although no decided traces of ancient rivers or lakes are met with in the island of Malta, there are deep gorges running northwards into the great valley, which may have been the beds of currents, or the off-

shoots and arms of lagoons, on whose banks and in whose turbid waters these animals lived and died. However that may be, the geologist cannot fail to be struck by the features of the Maghlak cave deposits; for they mark certain epochs of its existence—a turbulent time, when the rounded pebbles from the parent rock were conveyed therein, mayhap at the close of the Pliocene epoch; but how long afterwards the hippopotamuses' remains were deposited in the soft clay bottom of the cavern we cannot conjecture, as we fail even to guess the ages that have since passed away. We can see, however, that the period of the deposition of the rodent and birds was far more modern, and must have been one of calmness and prolonged tranquillity, possibly when the sea and land stood at their present level: moreover, the absence of fluviatile remains, and the presence of land shells throughout the deposit, greatly strengthen this hypothesis. I opine, therefore, that after a thick layer of calcareous earth or stalagmite had fully covered the hippopotamus' remains, thousands of the rodent either died of starvation, or were carried into the cave by some carnivorous animal. I cannot help leaning towards the latter opinion, from the fact that the remains were strewn about in the greatest disorder, and mingled with fragments of the long bones of birds.

It is scarcely possible to examine the two deposits, and not be convinced that each had a separate epoch. Ascending, we find the hippopotamus remains strewn over the clayey bottom; then trace the grey or red calcareous earth (the result of dripping from the roof and sides); gradually animal relics appear, layer after layer, until more than half are composed of incisors, molars, &c., with here and there a snail, which crawled in, and was enveloped in the gradual filling up of the cavern. These increase as we approach towards the surface; while the rodents' remains become fewer and fewer, until the earthy stalagmite passes into the stalactite, or calc spar, now forming. I think, therefore, there cannot be a doubt that long periods elapsed between the deposition of the two quadrupeds. The former is, doubtless, of vast antiquity; but from the position occupied by the rodents, it is not improbable that the animal lived in this island, within the historical period.

Near the town of Zebbug, on the side of one of the before-mentioned gorges, and about two miles distant from the Maghlak, in a North-west direction, a cave was accidentally dug into, when forming a house-tank in the sandstone rock. The floor of the cavern was covered with a reddish clay, and the entrance more or less blocked up with rubbish. Captain Spratt explored this place soon after its discovery, and found the teeth of a species of elephant, and the remains of a very large rodent, together with portions of a land-tortoise.*

In the Malta College Museum is a fragment of a young elephant's molar, and a portion of the straight tusk of a hippopotamus. I am credi-

---

* The particulars of this interesting discovery have, I believe, not yet been published by Captain Spratt, in consequence of the urgent and varied nature of his public duties.

bly informed they were dug up near Crendi, within a mile of the Maghlak cave; these remains, and what have been described, were all found at different points, within a circuit of six miles—in fact, the only localities in the Maltese islands where the hippopotamus and elephant have been yet discovered.

The fragment to which I have just alluded is much too imperfect to enable me to be certain as to the species. It appears, however, from the broad clefts, and the plates being very shallow at the sides, that it did not belong to the mammoth (as Dr. Gulia, an eminent Maltese naturalist, has supposed); the markings on the crown approach *E. Africanus*, which has been met with in the caves near Palermo, by Baron Anca, and Dr. Falconer. Through the kindness of M. Sant, of Citta Vecchia, Malta, I have been enabled to examine a very interesting tooth, which came into his possession about five years ago; it was picked up on a cliff on the south coast, near the valley of Dingli. I herewith append (*vid.* Pls. I., II.) an outline of this strange-looking relic, also a portion of the upper jaw and two teeth of the same animal, said to have been found in the island of Gozo; this, however, has not been confirmed.* Regarding the other having been discovered in the above situation, there is no doubt. It is evidently a penultimate molar, a good deal destroyed, but sufficiently perfect to show at a glance its connexion with the other. The necks of the teeth in both specimens are covered with a brown enamel, and their crowns divided by a deep valley; each lobe has a rugged, pit-like depression on its inner aspect; the top and sides of the fangs are worn by the tooth above. The first-named specimen is embedded in a piece of stalagmite. These wondrous relics require a thorough comparison with the earliest tertiary carnivores and marsupials, in order to determine the species: of one point, it appears to me, there can be no doubt, viz. that we have no animal with a similar dental construction among the fossils of the pleistocene epoch.

Such are the Maltese fossil mammalia. Few as they are, and meagre as are their histories, still from what is known of the tertiary fossils of that island, we are enabled to fill up a link in the chain which has already furnished strange and cogent proofs of the condition of the south of Europe during the ages to which they refer. Whether seen from a distance, or examined in detail, Malta is about the last island we could imagine had been tenanted by animals such as have been mentioned. That grey and barren rock had, nevertheless, an age of verdure. What is now a bare sloping sand or limestone, on which grow the lichen, the beautiful wild artichoke, or a few tufts of heath, or the sea-side euphorbia, was at one time covered with a productive soil and luxuriant vegetation; it may have been ages and ages before man appeared on the scene, or at least at the dawn of the human period. Tall reeds clothed the banks of its lakes, rivers, or lagoons; tree and shrub also flourished in profusion; for these gorges and valleys, seen here and there over the island, once resounded with the snorting of the hippopotamus, and the

---

* The above is in the possession of Captain Spratt.

shrill trumpet of the elephant, and were part and parcel of a land the major part of which is now doubtless under the blue waters of the Mediterranean. What a vast change has taken place in the physical geography of southern Europe since those times! In vain we attempt to peer through the gloom of the past, by the flickerings these bone caves disclose; but, although they send strange and fitful flashes across the mind, and show beyond the shadow of a doubt that, at least in this instance, what is now an island must have once been part of a continent, we know not, and may never probably discover with any degree of accuracy, *when* the important phenomena occurred, which ended in forming the Malta and Sicily of our times.* That there was a connexion between the two islands and Africa, during the later tertiary epochs, seems highly probable—the fact of the African elephant having been found near Palermo, as well as complete skulls of a species of hyena, very like the animal of Africa, leads us towards the supposition that there was also a union between Sicily and that continent. I am far, however, from attempting to found a theory on such questionable proofs. The prolific caves of Sicily will yet, doubtless, afford many more satisfactory evidences on that head.

I cannot, however, pass unnoticed the strange-cut flint "spear-heads" or "armes en pierre," as my friend Baron Anca calls them. Three of these are now before me from the Palermo caves. These rude implements of war or the chace require only a casual inspection, for us to discover that their sides could not have been fashioned by other than human ingenuity. Such implements found mingled with the remains of deer, hippopotamus, or elephant, unroll another portion in the map of the unrecorded past, and tell us of man's existence at an epoch far more ancient than previous evidence had determined.

Before closing this memoir, it seems requisite to notice the hypothesis, still entertained by a few, that the remains of animals were washed into the caves by diluvial waves or currents. Such may have been the case in certain instances; but, as a general rule, the evidence is strong in favour of a belief that the caverns were for ages the abodes of carnivorous animals. Such was the appearance of the Maghlak: although no re-

* An interesting discovery, not known when the Government Geological Map was constructed, is here worthy of being recorded, as it bears intimately on the ancient condition of the island. During my late survey of the coast opposite Filfla, and immediately under the Maghlak cave, I came on the fragment of a downthrow, composed of the Upper limestone and marl, which at once showed the connexion that at one time existed between the mainland and Filfla, as the latter is entirely composed of these formations: moreover, this portion of the downthrow and the water-worn fissures and caverns in the lower limestone of the Maghlak terrace and along the coast afford good cause for conjecture that a river once ran east and west, of which the downcast portion formed the southern bank. Captain Spratt informs me that he noted the above fault in 1859, and sent a notice of its existence to Earl Ducie and Dr. Falconer, along with a memoir of the Maghlak cavern and its contents.

mains of carnivores were found therein, still the condition and deposition of its fossils tend to no other reasonable opinion. It is probable that the herbivorous quadrupeds, from the change in the configuration of the continent, isthmus, or island over which they roamed, and the consequent failure of pasturage, died in numbers—some in caves, more in the open, where they were torn to pieces by carnivorous animals, who dragged the greater portion into their dens. In this way we can account for the fragmentary state of the Maghlak remains, and the preponderance of young animals. However that may be, we are not in a position to say with certainty; more facts are required, and it is to be hoped, not only with reference to Malta, but elsewhere, that when like interesting discoveries are made, there will be found a few among the population, who, if ignorant of their intrinsic value, may yet see in those "vestiges of creation" something deserving of a better fate than awaited the deposits of the Maghlak cave. To the student the subject of these imperfect details impart a corollary of striking interest, and shows that, although the formations of Malta are geologically speaking modern, yet how ancient are its primeval elephant and hippopotamus, which must have existed ages after the deposition of its uppermost rock.

DESCRIPTION OF PLATES.

PLATE I.

Fig. 1. A, B, C.—1A, profile view of the skull of *Myoxus Miletensis* (*nobis*); 1B, front view of the same, showing the outline of the orbital cavity, &c.; 1C, palatal view of same, showing the remains of three molars.

Fig. 2.—A and B, upper incisor; A, natural size; B, the same enlarged 2 diameters.

Fig. 3.—A and B, three upper molars of a middle-aged animal, showing the peculiar sinuous arrangement of the enamel plates; A, natural size; B the same enlarged 6 diameters.

Fig. 4.—A and B, a complete set of molars, with a portion of the upper jaw, of a young animal, showing the enamel plates extending across the crown of the teeth; A, natural size; B, enlarged 6 diameters.

Fig. 5.—A, B, C, a complete set of the molars, natural size, of the under jaw of an aged animal, in which the enamel plates are nearly obliterated; A, side view, showing the fangs partly embedded in the jaw; B, the same viewed from above; C, the same enlarged 6 diameters.

Fig. 6.—A, B, C, D, different views of a single molar of a young animal, enlarged 6 diameters, showing the arrangement of the enamel plates, and the position and shape of the three fangs; A, crown of molar, showing the small surface occupied by the enamel plates; B, side view of same, showing the position and shape of the fangs; C, the same viewed posteriorly; D, anterior view. The small cross represents the natural size of the tooth.

PLATE II.

Fig. 7.—A, B, C, right lower jaw of *Myoxus Miletensis*, viewed from within, with a complete set of molars, *in situ*, of a young animal, the enamel plates being very little worn; 7A, molar natural size; B, enlarged 3 diameters—the dotted lines represent the parts restored from Fig. 8; C, the crowns of the four molars, viewed from above, enlarged 6 diameters, showing the comparatively unworn condition of the enamel plates, and their peculiar convoluted arrangement.

Fig. 8.—Fragment of the posterior portion of a lower jaw, showing its bifurcation.

Fig. 9.—A, B, portion of the inside of a left lower jaw, with the fragment of the fang of incisor, *in situ;* B, view of the crowns of the four molars, enlarged 6 diameters.

Fig. 10.—A, portion of a left lower jaw, with a perfect incisor, natural size; B, incisor enlarged 2 diameters, showing the circular striæ of growth on its concave surface.

Fig. 11.—Portion of left lower jaw of *Myoxus Cartei* (*mihi*), natural size.

Fig. 12.—A, B, C, right lower jaw of a similar animal.

Although the general character of the teeth and arrangement of the enamel plates in these jaws are similar to those of the foregoing, nevertheless, the shape of the jaws differs so very considerably from them, and as this difference cannot be considered as due to either age or sex, I am disposed to look upon them as belonging to distinct species,—one of which I dedicate to Dr. Carte, in testimony of the valuable services he has rendered to me on this and other occasions.—A. L. A.

III.—*On the General Anatomy, Histology, and Physiology of Limax maximus (Moquin-Tandon).* By HENRY LAWSON, M.D., Professor of Physiology in Queen's College, Birmingham.

[Read Monday Evening, November 17, 1862.]

IT has often occurred to my mind, that the objects by which we are almost invariably surrounded are not unfrequently those with whose character and history we are least acquainted. How many are there, for example, who, though on terms of intimacy with the utmost minutiæ of some arabesque, or specimen of mediæval ornamentation, can accurately depict, from memory alone, the pattern of a well-known carpet, or the design of a drawing-room's tapestry? If so commonplace a comparison be not inadequate to the subject, I beg to offer it, as one of the circumstances which instigated the researches, upon which the results stated in the following pages have been based. The variety of *Limax maximus* selected for dissection has been most commonly the dark one, with occasional examinations of mottled specimens, the chief morphological distinction between the two, being the possession by the latter

of a shell, the material of which in the former is usually found in a condition of disintegration, mingled with the mucous exudation of the sac in which it is contained. We find, according to the philosophic investigations of Professor Huxley,* that the slug, like the other pulmonata, develops in the embryonic state, an abdomen or mass of tissue anterior to the anal aperture, in this way causing the intestine to bend with its concavity facing the nervous region of the body; and hence it comes under the head of mollusks exhibiting a "neural flexure" of the archetype of this naturalist.† The arrangement of the organs included in the economy of gasteropodous creatures, is generally stated to partake of irregularities, is said to be devoid of co-ordination, and is asserted to be asymmetrical. I cannot say that I have been very forcibly impressed by the truth of these dogmas, for to me, a very decided symmetry is apparent, and that too, in many instances, of the bilateral type. Thus in the nervous, the circulatory, and the special sense systems, we find the constituent organs equally divided between the two sides of the body: there are two salivary glands, and two principal divisions of the liver, lying, one of each, on either side of the median line; the lungs we may also to some extent distribute with reference to a central plane; and finally, there remain but the generative and digestive apparatus, which, though seemingly aberrant, we are not warranted in concluding to be asymmetrical till better acquainted with their phases of development. In a rude way, we may look upon this animal, as a tough, elongated pouch, containing viscera, and having attached to its dorsal surface, in its anterior third, a convex and in some measure pyramidal cap, which is composed of the *so-called* mantle. This in vertical section is dome-shaped, and is a perfectly closed cavity, in which is placed the loose mass of calcareous particles of the shell; below, it is limited by a delicate transparent membrane which lies upon the heart and pericardial gland, and seems by a process of splitting to pass beneath these latter also, in this way completely separating them from the great visceral chamber. I propose to treat of the anatomy of Limax after the following scheme:—

1. Tegumentary system.	5. Circulatory system.
2. Muscular "	6. Nervous "
3. Digestive "	7. Special sense and glands.
4. Respiratory "	8. Reproductive system.

INTEGUMENT.—The skin system is of the musculo-cutaneous type; and may be said to consist of three coats, an outer or dermoid, a middle or muscular, and an internal or fibro-vascular and calcareous. The first resolves itself into two layers: a more external stratum, which is transpa-

* "On the Morphology of the Cephalous Mollusca, as illustrated in the anatomy of certain Heteropoda and Pteropoda, collected during the voyage of H. M. S. Rattlesnake in 1846–50."—Phil. Transactions, 1853.

† Some difficulty is at first experienced in the endeavour to realize this change; but the author's explanation (note, p. 51, of memoir referred to) renders the matter most explicit.

rent, and, so far as I could observe, structureless, and in some instances detachable; and within this, a mass of fusiform endoplasts embedded in a clear matrix, which assume the fibrous character of connective tissue as they approach the next coat, from which they are inseparable. The muscular or central lamina is also composed of two layers of fibres, the most external being longitudinal, and those within them transverse; yet the line of distinction cannot be clearly drawn, for as you advance inwards you find the outer fibres gradually losing the longitudinal, and, by assuming an oblique position, in this way, passing almost insensibly into the truly transverse ones; the fibres at best are indistinct, and are composed of elongate endoplasts. The inner coat consists of meshes of connective tissue, tunnelled for the conveyance of venous blood, and impregnated with round granular particles of calcareous matter, which give that portion of it limiting the visceral chamber, a pure white lustrous aspect. I have not entered into the shell-question in these pages, because the shell in its mature form is more or less structureless, and its homologies can only be arrived at by an appeal to development, the study of which in this animal I have not devoted sufficient attention to.*

Muscular System.—The muscles in this animal are not numerous, as indeed they are not in any mollusk, and may be conveniently grouped under two heads—those blended with the integument, and those distinct. The former I have already described. The isolated muscles are very few in number, and embrace those of the tentacula, and the retractors of the head. In both cases they are flattened bands of a glistening semi-transparent appearance, and are made up of long fusiform endoplasts, with dark nuclei, and surrounded by a clear periplast. The retractor of the head is a long, tough, flat band, which arises from the integument of the right side, about the middle of the antero-posterior plane, and, passing beneath the viscera, reaches the nervous collar of the gullet; here it takes its course through the circlet of nerves, and beneath the œsophagus, and on approaching the head, bifurcates; the two filaments thus produced being inserted into the musculo-fibrous tissue of the head, with which they become continuous.

The tentacular muscles are much more complex in mode of arrangement, and are three in number for each side of the body. These three are united in such a manner, as to give rise to a more or less perfect equilateral triangle, whose base lies in the longitudinal plane, with the apex pointing laterally and a little upwards; the posterior extremity of the base is continuous with the dense skin of the foot, to which it is attached; and the anterior side is prolonged, and blended with the tissue of the foot in the median line, and just below the mouth. From the apex of the triangle springs the superior tentacle, and from the muscle constituting the base arises the inferior one—hence, if the basal chord con-

* For an admirable memoir on this subject, consult "Beiträge zur Entwikelungs geschichte der Land Gasteropoden," in "Siebold und Kölliker's Zeitschrift für Wissenschaftliche Zoologie," 1852, iii., p. 371.

tracts, the inferior tentacle will be drawn in, if the posterior side of the triangle is shortened, the superior tentacle will be brought in, and should the anterior band be stimulated, it will tend by its contraction more or less to place both tentacula in a position to allow of eversion by the usual means. A glance at the semi-schematic figure on Plate I., will suffice to make these remarks intelligible.

Digestive System.—The digestive system, with the appendages which appertain to it, forms the bulk of the slug's viscera, and in treating of it we have to speak of the following parts:—Head, salivary glands, gullet or pro-stomach, stomach, liver, and intestine. The head is the most anterior portion of the body; and, when deprived of the tentacula and integument which cover it, appears a solid, glistening, white structure, of a more or less spherical form viewed from above; in profile, seeming oval, the large end behind, and having projecting from its posterior inferior border a small whitish semi-transparent papilla. On its two sides above are seen the superior tentacles, and beside, and beneath, various branches from the cephalic or supra-œsophageal ganglia: moreover, the two most anterior ganglionic masses are strongly united to its external lateral surface, and their branches wind around it, as before described; it is about one-fourth of an inch long in an antero-posterior direction, and measures one-fifth of an inch transversely; interiorly it is hollow; it has in front an aperture—the mouth—and receives on the most superior border of its posterior surface the commencement of the gullet. Its cavity resolves itself distinctly into two—the upper or true mouth, and the lower or pharynx, which must be described separately. The mouth lies superiorly, and has its position indicated, by the conception of a right line uniting oral orifice and gullet, and which is horizontal. The outer opening is provided below with a fleshy lip, a modification of the general integument which is partially divided by vertical slits into squarish segments, and plays the part of an inferior jaw. Above, the lip is absent, its place being taken by a very distinct and perfect maxilla; this is a horny or chitinous structure, about one-eighth of an inch wide, and one-sixth of an inch long, which is soldered to the palate; it is of a brownish-yellow colour, and of a somewhat triangular outline, the base in front notched, and bent downwards at right angles to the rest, thus performing the office of teeth, the apex pointing to the œsophagus, and the whole non-dental surface constituting, as it were, a second palate; behind and close to its junction with the gullet are located the openings of the salivary ducts. The pharynx or inferior cavity is a kind of pocket, or diverticulum, which I can compare only to an inverted and bisected hollow cone, flat behind, and angular in front; it is lined with a roughened membrane, and has pointing from it downwards and backwards into the visceral cavity, the papillary process above alluded to, which organ, can by an eversion be brought forward so as to lie obliquely in the pharyngeal sac. The roughened membrane with which the pharynx and tongue (for so the papillary organ must be termed) are covered, when seen under the microscope, is a very pretty object; it is covered by a multitude of closely

set spines, of a calcareous nature, arranged in linear order side by side, the lines lying one behind the other. Each spine consists of a central portion or body, which is elliptical, and an exquisitely slender curved hooklet springing from this latter. The points of the hooklets all project backward, and the spines are placed one behind the other, and not alternately, with an exceedingly small rounded process rising from the membrane between every pair. The functions of the head are two—those of prehension and mastication, deglutition being achieved through the contraction of the gullet. Now, the first, as I take it, is performed by the jaw and lip, which, grasping the leaf or other portion of vegetable matter, bring it within reach of the pharynx; arrived here, it is acted on by the salivary secretion, which has been poured into the pharyngeal bag; then, by a series of compound movements of the tongue, it is submitted to a rasping process between the hooklets of the latter and those of the pharynx; and eventually, having been reduced to a state of very fine division, it is tilted backward by the tongue, and, being now within the grasp of the œsophagus, is gradually carried onward to the stomach. The head is principally composed of connective tissue; but about the oral orifice on the inferior border a considerable band of nucleated unstriped fibres may be observed; a few fibres of a similar description are mingled with the layers of connective web, and the tongue—beneath the spinous coat—is almost entirely muscular.

The salivary glands are two in number, extremely delicate in texture, and of a pale white colour; they lie on either side of the œsophagus in the respiratory region, being covered by the heart and pericardial gland, and resting in part upon the great supra-œsophageal ganglia, they are bound to the gullet by numerous arterial branches common to both, and are flattened and leaf-like in appearance. Each gland has a length of five-eighths of an inch, from side to side measures about one-fourth of an inch, and pours its secretion from the mouth by a duct, white and narrow (in which I, less fortunate than Müller, have not detected ciliated epithelium), which passes from the gland anteriorly beneath the great ganglia to the orifice of the gullet, immediately above the pharynx. In general structure they are loose, and made up of a number of minute lobules, arranged in clusters upon the terminal ramifications of the duct. Microscopically, each lobule is of an oval shape, filled with transparent fluid, and contains, floating in this latter, many well-marked circular endoplasts with nuclei in their interiors, and has attached to its inner edge a delicate twig from the excretory duct. (Plate III., Fig. 3).

The gullet is a canal, at first narrow, as it leaves the mouth; but having passed the nervous collar, it widens so as to resemble a funnel, and its walls become more dense and muscular; it is usually of a dark brown colour, this being for the most part owing to a quantity of bile which it nearly always contains, and which renders it not unlikely that much of the true digestive process is gone through here. Like the other divisions of the alimentary canal, the œsophagus exhibits the tendency to curve spirally in its course from head to stomach; and though prior to

its passage through the second nervous circle it is horizontally situate in the median line, yet between this and the stomachal sac it turns to the left and downwards, and again bending to the right in the central axis, and equidistant from head and caudal extreme of body, it terminates in the stomach. It is related above, to the heart, pericardial gland, lung-sac, nervous masses, anterior lobe of liver, and large and small intestines, the rectum just passing over it, between the head and second ganglionic centre; it rests upon the foot (having the pedal gland below it), and inferior nervous masses; is bounded on the right by the anterior portion of the reproductive organs, on the left by a fold of the large intestine, and on both sides by the tentacula and their muscular apparatus. It is little more than two inches in length, has a calibre of one-sixth of an inch at the cardiac orifice of the stomach, and measures diametrically one-twelfth of an inch as it leaves the mouth. Histologically, the œsophagus is identical with the other divisions of the alimentary canal, except the stomach, and therefore the sketch of its microscopic anatomy will suffice for all except the latter. Two coats enter into its compositions—a fibro-muscular, and pseudo-mucous, neither of which, however, can be detached without injury to the other. The first, most external, or visceral layer, when examined under a low power presents to the eye a collection of muscular and connective tissue, fibres, nerves, and blood-vessels, mingled heterogeneously together; but if the larger branches of the two latter be carefully teased out, and a small section submitted to a much higher power, it is then seen that the outer coating is composed of two distinct strata of nucleated, non-striated, muscular fibres, crossing each other pretty nearly at right angles, and blended with them, and pursuing an undulating course, a few fibres of the elastic connective tissue (Plate III., Fig. 6). The muscular fibres are absent in some localities, thus leaving small rectangular spaces between the strata. The second lamina is with difficulty prepared for examination; it is perfectly transparent, and so far as I could observe, entirely devoid of epithelium ciliated and non-ciliated, and perfectly structureless, seeming to be a kind of protective glazing thrown out over the external coat.

The stomach is an oval-shaped bag, of a dark-brown colour, into one end of which open together the gullet and intestine, so that these latter appear almost continuous, and the stomach itself looks as though a diverticulum. It is placed in the centre of the antero-posterior plane, inclining a little to the left; to its dextral end are attached the gullet and intestine, its sinistral extreme being free; it is supported by the foot and oviduct, has the ovary behind, the two bile ducts in front, and the liver on either side, and on its superior edges; but above it is in relation with the inner surface of the integument only, and hence it is one of the structures seen on removing the dorsal covering. It is about half an inch long, five-sixteenths deep, and one-fourth wide. As in the gullet, so here we have two separate laminæ—the outer, or muscular, and the inner, or mucous. The external coat is made up of three rather well marked muscular layers—a circular, a longitudinal, and an oblique—which present the same appearance as those of the œsopha-

gus, with this exception, whilst the nuclei in the fibres of the latter were short, in those of the stomach they are large, distinct, and fusiform. The inner stratum is nothing more than a bed of oblong endoplasts, resting upon the outer; a zone of indifferent tissue or a "Protomorphic line" (to use Professor Huxley's expression) being interposed. The intestine is a tube, musculo-membranous in character, as wide as the gullet for about one-third of its length, but gradually diminishing in diameter as it approaches the anus. From this peculiarity that portion of the gut which is nearest the stomachal cavity must be termed the larger, and the remaining division of the canal the smaller intestine; except towards the anal aperture, it is of a dark brownish-green colour, which is due in some measure to the vegetable and biliary contents. In its entirety it averages a length of seven inches, is of equal capacity with the gullet as it leaves the stomach, and measures not more than one-tenth of an inch at the anal orifice. It is better in treating of its relations, to assume that it is a single tube, and in this way avoid the difficulty of drawing the exact line between the greater and the lesser gut. The intestine, then, leaving the pyloric end of the stomach, travels obliquely forwards and upwards, beneath the liver, and above the œsophagus, where it is covered by the integument only, to the right lateral respiratory region. Arrived here, it makes a sudden turn, and passes beneath the gullet to the left; next it curves slightly upwards, and then downwards, being still upon the left, and descends again, coursing beneath the œsophagus, and toward the right side. It now ascends, and, going to the left, above the gullet, and below the liver, it is lost sight of. Continuing its course upon the left, it approaches the stomach, its convexity reclining against this organ. At this point, by a perfect sigmoid flexure, it encloses a portion of the liver (still, however, beneath the upper part of this latter), winds to the right across the œsophagus, and, passing under one of its own folds, and finally beneath the heart and pericardial gland, and above the gullet, it terminates in the anus, at the superior angle of the pulmonic orifice, being retained *in situ* by the united muscles of the retractor capitis, which are looped around the gut. The anus is closed by a circular band of elastic tissue, which encircles the tube, at its junction with the integument.

The liver is by far the largest and most complete gland in the economy of this animal, and, when separated from the other organs with which it is connected, appears as two separate structures, exhibiting what we should not have been led to expect, similarity of *size* and form. These are of a dark brown colour, and have their under surfaces crowded with exquisite white arterial ramifications. The liver shares the general tendency to assume a twining arrangement; for we find it adapting itself to the various folds of the intestine, and so embracing the latter, that a separation of the two involves some delicate dissection. Each lateral division is conjoined to the stomachal end of the œsophagus by its wide and easily distinguished hepatic duct; that of the left side

pouring its secretion into the gullet about one-sixth of an inch anterior to that of the right. Each is of an irregular oblong shape, bearing some likeness in outline to a lanceolate acute leaf, with notched edges, and consists of numerous large and small lobes, bound loosely together by a web-like connective tissue, and attached to branches of the principal duct. It measures about two inches in length, and at its widest part is more than half an inch in breadth; but in some specimens which I have examined the liver did not exceed an inch in length, and was proportionally narrow. Every lobe may be divided into a number of component lobules, and each of the latter comprises seven, or ten still smaller structures of an uneven polyhedral type, within whose walls may be observed numerous endoplasts, some of them large, with yellow or light brown contents, others small, without nuclei, and also a considerable amount of loosely floating granular particles. The duct on entering one of the lobules divides into several branches, which surround the many-sided compartments, and become eventually undistinguishable from the fibrous septa; but never have I detected a communication between duct and theca, the two portions of the organ being as separate as in the human liver, according to view of a recent investigator.* (Plate III., Fig. 1). Had there been any direct connexion, it could not have remained unobserved, since it is easily perceived when it does exist, as in the salivary glands. The bile is a dark brown liquid, with a faintly unpleasant smell, and a nauseous sweetish taste, and which is poured in large quantity into the gullet when the animal has been without food for some days. Under the microscope it seems a transparent fluid, suspending many clusters of dark brown granules, and nucleated and non-nucleated endoplasts.

GENERAL REMARKS.—Lebert, in a communication to Müller's Archives for 1846, has given many figures of the head, tongue, and spinous membrane of Limax; but in some instances I conceive he has not accurately depicted the structure and form of these organs. The palate, judging from his sketch, seems but a mere blade, proceeding from the central portion of the jaw, which is not the case, the whole palate and jaw forming, when flattened, a distinct triangle, two of whose sides are slightly concave outwards. Again, he has certainly mistaken the arrangement of the processes attached to the lingual membrane, inasmuch as he has placed them in alternate rows, and has omitted the intervening mammillary elevations. The head also, I fancy, is too much prolonged. Finally, his representation of the muscular fibre I cannot reconcile to anything I have perceived. It might, at first sight, seem difficult to reconcile Mr. Handfield Jones's views of the functions of the liver to the conditions under which the hepatic circulation is carried on here, these being different from what we meet in vertebrata; but the ap-

---

* On the Anatomy and Physiology of the Liver. Handfield Jones.—"Phil. Trans." for 1846, 1849, 1853.

parent difficulty disappears when we know that, if the special secretion were thrown out into the visceral cavity, it would be at once taken up by the veins.

Respiratory System.—The function of respiration is carried on by means of atmospheric air, introduced into a special cavity, containing numerous blood-vessels upon its surface, and this cavity is termed the lung. The respiratory organ is usually described as a ring surrounding the heart; this, however, is not correct. It is a double sac, one pocket of which is situate on the right, and another on the left side, having two channels of communication, by which the air is conveyed to every portion of the vascular surface. These pouches are placed in the thoracic region of the body, and are constituted externally of the general integument, and within of a delicate fibrous membrane, which also serves to form their limits; their upper borders are bounded by the inferior surface of the shell cavity; and below they are separated from the viscera by a septal fold of their inner membrane, which also forms a posterior partition between the lung and abdomen; anteriorly, they are closed in by the same structure, and internally they are related to the heart and pericardial gland which are placed between the two sacs. The connecting channels cross the body, one in front of the pericardial gland and heart, and the other, immediately behind them. The air is admitted through an orifice of an elliptical form, which is upon the right side, near the middle lateral line, and about half an inch from the upper tentacle. The great veins, which carry the blood to the lung are two in number, one for each of the pockets, in the external walls of which they are grooved, being merely, as it were, ploughed channels in the integument, which have been covered in by fibrous membrane; each sends off several branches from its upper and lower edges, which respectively pass upwards and downwards, curving in their course, with their concavities facing each other, and terminate in the border of the pericardial gland. In the outer portions the vessels are, as I mentioned above, but passages in the integument (which here, from the particles of carbonate of lime embedded in it, is white, as in the other regions of the body); but internally they lie between two transparent layers of membrane, and from this circumstance are easily observed in their passage to the pericardial gland. Each division or sac of the lung measures about half an inch in length, and is a little more than a quarter of an inch from above downwards; the width is variable, depending as it does upon the condition of the body as to contraction or elongation. The course of the blood through the pulmonary vessels is more properly described under the head of circulation.

Circulatory System.—The course of the blood, in its passage through the bodies of mollusks has long been misunderstood. Heretofore it has been thought that a perfect circulation existed,—that is to say, a complete series of channels, by which the nutrient fluid was conveyed from the propelling organ to the various regions of the body, and returned to

the heart. Milne Edwards* has done much to correct the errors of the earlier investigators; but as his observations do not extend to Limax, and since the latter genus and that of Helix, the course of whose circulation has been traced out, are so widely distinct anatomically, the mode in which the blood is carried to, and from the heart and pulmonary organs of the slug, has not as yet been distinctly explained. I have most carefully pursued the examination of this subject, occasionally with the assistance of injections prepared with new milk; and the result has been the adoption of the following view:—

The blood, having been expelled from the heart, travels through the short aorta and its two divisions, in this way reaching the head, reproductive organs, intestinal canal, and liver; and, having arrived at the terminal ramifications of the arterial vessels, is poured, through their open extremities, into the abdominal and sub-thoracic cavities, thus bathing the external parietes of the viscera. These cavities are continuous, and are clothed without, by the general integument, in whose walls the venous channels are grooved. Now the veins commence, by minute apertures, which admit the blood hitherto contained in the visceral chamber, allowing it to pass into their smaller branches. From these it then flows into the larger vessels, and finally is transmitted, by the great pulmonary vein of each side, to the respiratory sacs. It is here that difficulty has been invariably experienced in tracing the channels by which the blood travels to the heart,—some contending that a portion flowed to the so-called kidney, whilst the remainder was brought on to the heart by a large pulmonary vessel; —others, that the blood was here poured out into a sinus or lacuna. Both these ideas I conceive to be erroneous; the more so, as I have been unable, after the closest scrutiny, to detect any single pulmonary vessel which might convey the blood to the heart; and besides, that the relations and character of the quasi-kidney have been *most certainly* misinterpreted. The circulation in this locality is most complete and peculiar, and can be seen, with more or less distinctness, by removing the mantle and membrane of the shell sac. When this has been done, it will be observed that the blood travels in the direction I have endeavoured to indicate diagrammatically, viz.:—Having been poured by the great pulmonary vein of either side into the numerous lesser ramifications of the lung membrane, and been in this way fully exposed to the atmospheric air, it flows in two principal directions according as it has passed from the upper, or lower, borders of the great lateral veins. That which has been sent upwards flows in obedience to the limits of the pulmonary sac—first superiorly, then horizontally, and finally inferiorly—till it gains the external edge of the pericardial gland; and, conversely, that which left the under surface of the vein travels first inferiorly, then horizontally, and eventually ascends till it arrives at exactly the same position as the rest. Here, then, we find all the blood

* Ann. des Sci. Nat. viii. 1847.

which has traversed the respiratory reticulation at one period or other of its career; and from this it passes internally through the pericardial gland, in a perfectly centripetal manner, till it has reached its inner border. This latter expands, and constitutes—by a double sector-like fold of membrane, whose arc is confluent with the anterior division of the gland, and the junction of whose sides is intimately attached to the heart—a capacious sinus. Into this expansion the blood is next introduced, flowing readily into it at its immediate union with the gland, and being conveyed from the posterio-internal border of the latter by a canal partly circular, whose concave edge lies against the heart, whose convexity is continuous with the gland, and whose two orifices open into the lacunal cavity referred to. From the sinus the blood is transmitted to the heart by an aperture of communication between the former and the base of the latter; finally, by the contraction of the heart, it is propelled onwards through the aorta and its divisions (regurgitation being prevented by a small fold of membrane), to the different systems of organs, and so on as before. The heart is a thin muscular bag, of a somewhat triangular or pyriform description, and of a faintly flesh-like colour. It is placed in the thoracic region, being surrounded by the pericardial gland, bounded below by the fibrous membrane separating the heart-chamber from the visceral sac, and above by the floor-tissue of the shell-bag. It lies obliquely, its apex pointing backwards and to the right, and its base in the opposite direction. It measures a quarter of an inch in length, and an eighth of of an inch, or thereabouts, in width. It is wrong to describe the heart as being composed of an auricle and ventricle: it is a simple bag, having but one cavity, and not presenting any division by constriction or otherwise. It is almost wholly formed of *non*-striated muscular bands, interlaced in the most complex manner, and firmly united to each other at their extremities. The fibres, if they may be so termed, are filled with long fusiform endoplasts, containing clear nuclei. Examined under a low power, a very interesting arrangement is observed in connexion with the contractile structure. A number of muscular cords are seen on the internal surface of the heart, which are thus disposed:—They pass from two centres, which are situate about the middle of the lateral surfaces, in a radiate way, being continuous at their ends with the ordinary fibres; and in this manner they form two star-like elevations, much resembling the muscular cords in mammalian hearts, and probably serving a similar purpose. The true auricular chamber is the sinus to which I have alluded, but it is not contractile. The heart gives about twenty beats in the minute, each contraction being succeeded by a dilatation, and then an interval of repose following. During the period of rest the sector-like expansion is gradually filling, and becoming convex; on the moment of dilatation, by the tendency to vacuum which is occasioned, it is emptied of its contents, and then, contraction ensuing, the blood is forcibly driven through the arteries.

The arterial system consists in the aorta and its branches, with their numerous divisions and subdivisions. The aorta arises from the apex of the heart, and, on attaining a length of one-sixth of an inch, it divides into

two branches, measuring each one-twenty-fourth of an inch in diameter, which continue together for a distance of a quarter of an inch, till they reach the intestinal fold. One branch then (both having crossed the gut) becomes recurrent; and, passing beneath the intestine, runs downwards and forwards, parallel with the rectum, and beneath the generative organs, heart, and kidney, and becomes lost in supplying the gullet and organs of the head. The posterior branch passes backward toward the stomach, and in this course gives off about twenty branches to the intestines and liver; the intestinal branches being given off distinctly, and passing over the latter organ to their destination. These vessels divide and subdivide extensively, and form the most exquisite ramifications upon the alimentary canal, with which they contrast very markedly, being themselves of a pure white colour, whilst the intestine, from its vegetable contents, is green. Arrived at the stomach, the main artery bifurcates,—one branch passing backward, to supply the ovary and cardial lobe of the liver; and the second being transmitted to the stomach and left division of the hepatic gland, upon the inferior surface of whose lobes the most beautiful arborescent ramifications may be observed.

I am not disposed to coincide with the view of Erdl* that a capillary net-work exists—

1stly. Because it is not detectable.

2ndly. Because the rootlets of the veins terminate by apertures.

3rdly. Because the whole of the visera in the posterior part of the body are completely unattached *below* to the integument; and the as the principal arterial supply is to their inferior surfaces, had there been any intervening series of vessels, the integument and viscera would be adherent to each other in this locality. The arteries are composed of nucleated muscular fibres, having buried in them clusters of calcareous granules, which give the snow-white colour to these vessels. I cannot say I have been enabled to confirm the truth of Siebold's assertion, that *the arterial extremities are formed of calcareous particles alone*, the organic tissue being completely absent; for in every specimen that I examined, where it was possible to arrive at any clear decision, I most distinctly observed intermingled with the lime granules long nucleated endoplasts. The veins, as I before stated, are merely channels ploughed in the musculo-fibrous tissue of the skin, covered on their inner surface with a fold of transparent membrane; the great lateral vein of either side begins near the caudal extreme of the body, and travels forward horizontally to the lung sac, at a distance of about half an inch from the median line of the foot; it increases in calibre as it approaches the lung, and on joining this organ receives numerous branches from the upper and lower portions of the integument.

The pericardial gland, or kidney, as it has been styled, is, in my opinion, no more an urine gland than is the heart or liver; nor, in-

* De Helicis Algirae: Bruxelles.

deed, can I see any just reason why it has received this appellation; for I conceive the assertion of Jacobson, that it contains uric acid, is of no weight whatever, seeing that it is based upon the idea, that murexide is produced when the dried kidney has been subjected to the action of nitric acid and ammonia. Undoubtedly these reagents give rise to a reddish stain, which I fancy does not need the ammonia for its production; but it is equally true, that a portion of the liver, when placed under similar conditions, will give *apparently* the same results. Moreover, the statement that this gland possesses an excretory duct, is entirely without foundation, and I can only account for its origin, by supposing that in emaciated individuals, the rectum has been mistaken for a duct leading to the respiratory orifice; notwithstanding the most patient and persevering endeavours to discover something which might be construed into a duct, I have failed signally to detect anything of the kind.

This gland constitutes a sort of collar surrounding the heart; is bordered externally by the lungs, and within by the semicircular canal, and sector-like sinus; it is of a dark reddish-brown colour, and measures from side to side (including heart and sinus) more than half an inch. It is made up of a great number of lamellæ, placed against each other like those of a fish-gill; and, viewed under the microscope, each of these is seen to be composed of numerous irregular vacuoles, containing within them solid non-transparent round incompressible nuclei. Between these lamellæ numerous blood-vessels may be observed travelling from the lung to the heart sinus, and giving off several branches, which, passing between the vacuoles, anastomose frequently. The pericardium embraces this organ and the heart in its folds, forming, on the one hand, the floor of the shell-sac, and on the other, the roof of the thoracic gut chamber, and being perfectly transparent, admits of our observing most satisfactorily the movements of heart and sinus. I do not appreciate the necessity for assuming that there is any kidney in the economy of Limax, nor if I did, should I therefore conclude that this gland was its representative, simply because one of the compounds discoverable in the urine of man was found, or said to have been found, here also; for, pursuing the same line of argument, had not the kidney of man been discovered, its being known that the urea is found in the sudoriferous secretion, would constitute a valid reason for asserting that the human kidney was located in the skin. From the description of some of the earlier anatomists, an immense deal of confusion has resulted, owing to the kidney being, according to one or other, termed the muciparous gland, organ of the purple, etc., and each of these being in turn confounded with portions of the generative apparatus.

Nervous System.—This is composed of three separate ganglionic masses, two superior and one inferior, which, by means of connecting cords, constitute three distinct rings. The first lies upon, the second surrounds, and the third is placed immediately beneath the gullet, and springs, as it were, from the second. The two latter are by far the most distinct, and, from the circumstances of their size and contiguity, have been generally

supposed to embrace the entire system. The anterior ganglia are two in number, exceedingly minute, measuring about the one-twentieth of an inch in length, and situate on either side of the enlarged and spheroidal head, being at the superior and posterior border of this organ. They are of a dumb-bell shape, slightly curved, the concave edges embracing the convexity of the pharynx. They are of a whitish-yellow colour, but do not contain as much calcareous matter as the ganglia of the posterior divisions. They are attached to each other at their posterior expansions through the medium of a strong nervous filament, measuring one-fourth of an inch in length; from their anterior extremities eight nerves pass off, four on each side, to supply the various portions of the gustatory and lingua-prehensile apparatus; finally, from each posterior bulb a minute lingual twig is seen passing to the inferior surface of the gullet, and two long intermedial branches, which take their course backwards, on the upper surface of the œsophagus, for a distance of about three-fourths of an inch, and terminate in the *second circle*.

This is formed of two irregular oblong pieces (one lying on the gullet, the other beneath it), and a connecting nerve, which passes vertically downward on each side, and which, though apparently a single flattened structure, is actually composed of two riband-like nerves, from which *no branches* are given off. The upper ganglionic mass is slightly concave, both anteriorly and posteriorly, but more so behind than in front; it is composed of two ganglia, which have become completely amalgamated, and which are indicated by a transparent colourless spot at each extreme. That these ganglia are not *merely contiguous*, I have satisfied myself; and from my own repeated observations must give unqualified denial to the assertion of Von Siebold, that the ganglia, though fused into one in murex and others, *are not so in Limax*. This nerve-mass is easily seen on removing the heart, intestine, and reproductive organs, and is the more readily perceived owing to its snowy whiteness (which, by the way, I imagine, is due to the presence, in large quantity, of calcareous granules; for when the structure has been for some time immersed in acetic acid, the colour is lost, and the mass becomes less or more transparent). From the translucent and crescentic ends of this supra-œsophageal mass, four pairs of nerves arise; of these, the first pair passes to the superior tentacles, supplying these organs with filaments, and sending a branch, which is the *true optic nerve*,* to the eye. The second pair is distributed to the lower tentacles and lips. The third pair runs downward and forward, and, after a slight degree of ramification, is lost in the tissue and muscles of the inferior tentacula. The fourth and most posterior pair passes forward, and being lost upon the mouth and adjacent structures, deserves the name of buccal.

The third ring we now arrive at: it is about as wide as the second

* Jean Müller maintains this view also, which, so far as I could observe, is the correct one. It is strange, then, to find Siebold contending that the optic nerve is distinct all through. For Müller's remarks consult Ann. des Scl. xxii. 1831.

(which measures transversely somewhat more than one-eighth of an inch); indeed *its* upper ganglionic expansion is nothing more than the inferior mass of the latter; its superior component is oblong irregularly, and not very symmetrical, slightly convex anteriorly, and concave behind, with its extremities noduliform, and pointing forwards; it is directly united by fusion to the lower mass; the latter is composed of three ganglia, soldered to each other arciformly, the concavity being directed upwards. The two portions of this ring are so closely related, that to the naked eye the existence of an intervening space is *barely* perceptible. It is from this congeries of ganglionic centres that the different viscera and the great pedal muscles receive their nervous filaments, which, though numerous at the periphery, are referrible to five primal pairs, and an azygos central branch passing to the posterior surface of the head. The first, passing from the superior extremities of the mass, supplies the heart, part of the gullet and stomach, and the lungs; the divisions of this pair are peculiar, for many of the threads, after separation, again unite, thus forming a very rudimentary plexus. The second, third, and fourth pairs originate in the lateral portions of the ring, and all terminate in the walls of the intestine, the reproductive organs, and the liver. Fifth pair, and most inferior, arises from the inferior and internal border of the external walls of the ring, leaving a clear central and included space from which *no nerves* start. The nerves comprised in this couple are the "great pedal;" they direct their course backward on either side of the central foot-gland, and beneath all the viscera, and after having transmitted three or four branches each to the musculo-connective tissue of the foot, they end, at a distance of two inches from their origin, in that portion of the pedal organ just beneath the ovary and last lobe of liver.

General Remarks on, and Histology of, Nervous System.—The nerves, viewed under the microscope, present rather the aspect of connective tissue than the tubular appearance characteristic of vertebrate nerve-fibres, the outer edge of each individual fibre seeming dense, and to have undergone more decided differentiation than the inner portion. On entering the ganglion, the nerve splits up into a considerable number of delicate threads, which become lost between the endoplasts of the ganglion itself. On no occasion have I been enabled to discover the division of the ganglion into compartments, as described by Von Siebold. I have prepared sections carefully, with the assistance of Valentin's knife, and have subjected thin slices to the action of the compressorium, and in both cases the same appearance was presented to the eye, viz.—an opaque periplast, consisting of fat granules and calcareous particles (as proved by the transparence ensuing on immersion in a mixture of acetic acid and ether), embedding numerous large and readily perceptible endoplasts of the following kinds:—

a. With an outer wall, granular contents, and a well-defined nucleus and nucleolus.

b. With two outer walls, the substance between them clear and non-granular, the interior filled with a granular material, a nucleus, and two or three well-marked nucleoli.

Both varieties were of an irregularly elliptical outline, both large and small, but never pedunculated. Owing to Ehrenberg's observations on Arion*, I had expected to find tailed globules in Limax, but they have no existence. Anderson's† woodcut is calculated to mislead, because he has not given the proper number of nerves arising from either the superior or inferior ganglia; and, besides, he has fallen into error in representing two pairs of filaments as united to the bands connecting the supra- and infra-œsophageal centres. One would suppose also, from his engraving, that the pharyngeal nervous masses had no direct connexion with the others.

Senses—Organs of Hearing.—It is stated in most works on the anatomy of mollusks that these organs are represented by a pair of transparent membranous saccules, containing either siliceous or calcareous particles, termed otolites, and placed upon the inferior nervous masses. I frankly confess, that I have never succeeded in finding them present in Limax. I have taken great pains to detect them, but in vain; and although naturally anxious to discover some apparatus which I could set down to their credit, up to this time, my efforts have been unsuccessful. From this circumstance, I am led to suspect that in this creature no auditory mechanism really exists; and this suspicion is somewhat strengthened by the fact that, the so-called ear-vesicles are said to be among the first detectable organs in the embryo, which I should not suppose probable as regards an appendicular sense system. To speak more plainly, if we were informed that in the early embryonic existence of a vertebrate animal, the most well-marked system was the auditory, should we not be inclined to fear that there was some blunder in the statement, or the observation? And, besides, if the otolotic capsules be located upon the lower nervous centre, as is asserted, and thus virtually buried in the viscera, how are the sonorous impressions to be received from without? Surely, this would not be an advantageous arrangement of parts, nor one in obedience to the simplest laws of acoustics; for the only method by which a vibration could be conducted to the receiving vesicle would be through the mouth and œsophagus, so that the slang expression "swallow" should not be at all inapplicable.

Organ of Touch.—Some state that the tactile sense is resident in the inferior tentacula, these being, according to the same authorities, provided with bulbous enlargements similar to those of the upper ones. Respective of their function, I can offer no comment; but I cannot just now endorse the opinion that nervous expansions exist here; an enlargement of some kind is occasionally seen, but I am not prepared to admit

* Unerkannt Struktur, &c. Tab. 6.
† Todd's Cyclopædia; article Nervous System, Comparative Anatomy of.

its nervous character. Moquin-Tandon attributes to these tentacula the function of smell.

TASTE.—This faculty, I am disposed to think, resides in the rugose integument forming the lateral boundaries of the mouth. This portion of the labial organs is supplied on each side with a branch of the inferior tentacular nerve, and here a peculiar and interesting nervous arrangement may be observed. The branch, on reaching the tegumentary fold alluded to, widens as it approaches its extremity, and terminates in a pectinate expansion, which is embedded in the delicate skin of the lip. This comb-shaped structure results from the division of the final portion of the filament—for about one-eighth of an inch distance—into a series of minute twigs, which pass off on either side, and become lost in the neighbouring tissue.

EYE.—The eyes are two in number, situate one at the extremity of each superior tentacle, and are recognisable as a pair of small black spots within the membrane by which they are surrounded. By careful manipulation, the eye, together with the tentacular and optic nerve, may be separated from the encompassing, darkly-stained connective tissue, and then is seen, the origin of the nerve of sense, in the extremity of the tentacular branch. The latter, just before it terminates at the end of the tentacle, expands into five or six short, thick, and unequal divisions, exhibiting a palmate form, the fingers being arranged in such a position as would be assumed by the human hand when grasping a large ball; and from the middle of the palm, thus constituted, a very fine nervous thread travels to the eye-ball—the intervening distance being exceedingly short. This attenuate nerve, having reached the eye, *apparently* enters the posterior part of the sphere; but, so far as I could observe, it *really* becomes blended with the membrane of the eye-ball, which is a connective tissue structure; and, after the choroidal pigment has been completely removed, the two tissues—those of the optic nerve and sclerotic—appear not only continuous, but also identical in structure; and this peculiarity, although at first sight anomalous, is at once appreciated by an appeal to the investigations of Professor L. Beale into the structure and homologies of connective tissue.* Indeed, I very much doubt that any structure resembling a retina has ever been observed in Gasteropods; and I conceive that this idea is borne out by the fact, that, though Von Siebold, in treating of the organs of vision generally among Cephalophora, writes, "The internal surface of the choroid is covered by a whitish pellicle, which is undoubtedly a retina," he then adds below, as if hesitatingly, "Krohn affirms that he has *seen* this white pellicle with Paludina." For my own part, I must confess I am sceptical as to its existence, having never observed the faintest trace of it myself. The sclerotic membrane forms a more or less spherical sac, which is quite

* *Vide* Quarterly Journal of Microscopical Science, October, 1861; Archives of Medicine, October, 1861; Med. Chir. Rev., 1862; Beale on the Tissues, &c.

transparent at a point opposite the apparent attachment of the nerve. Internally this sac is lined with exceedingly fine black granular pigment, which, so far as I could perceive, is not enclosed in cells, but is embedded in the inner wall of the sclerotic, and, for the most part, is disposed in regular lines,—long and short alternately,—that assume the horizontal position. The eye-ball owes its globular form to being filled with a thick, tenacious, perfectly transparent vitreous humour. This is very well observed by exerting compression on the sac, when, a portion of the wall being ruptured, the contained gelatinous matter is gradually forced out in a worm-like manner, or exactly as is semifluid oil colour from the leaden tube of an artist. The cornea is at once perceived, and on two or three occasions I have teased from it a small, solid, transparent, pointed elliptical body, which *may* serve the purpose of a crystalline lens; but I do not think this is easily detected. The integument is attached to the eye-ball; but I do not believe it passes over it, else I should suppose there was a second cornea, unless, indeed, it were termed conjunctiva. Yet Siebold states that the skin passes over the eye, as a thin transparent lamella. This anatomist also says that in *no* case can ganglionic globules be seen in the expansion of the optic nerve; but why, I cannot understand, it being a matter of the greatest ease, to observe the very well marked elliptical endoplasts, with their nuclei and granules.

Pedal Gland.—This consists of a central canal, closed behind, open in front, traversing the internal portion of the tissue of the foot, from the posterior extreme of the creature to the integument immediately beneath the mouth, and having attached to its lateral borders clusters of endoplasts, which simulate the structure of follicles. Between these clusters numerous blood-vessels lie, and hence, did we suppose the existence of a water-vascular system, we might conceive of the aqueous fluid being, through this canal, introduced into the blood. Various functions have been ascribed to this organ, among which not the least *seemingly* absurd is that of smell, which Leidy has set down to it.*

Reproductive System.—The group of organs which collectively make up this system is, as we might anticipate, akin to that represented in the genus Helix. The parts are those of the two sexes combined, that set which is characteristic of each sex being morphologically complete in every individual, and not as Steenstrup† would have us believe, the non-abortive moiety, of a complex apparatus, which exhibits a complete bilateral symmetry. For perspicuity the parts composing this machinery may be thus classified, as in the case of Helix:—

---

* Silliman's American Journal of Science (May, 1847), and Ann. Nat. Hist. vol. xx, 1847.

† Steenstrup, "Undersögelser over Hermaphroditismens Tilvaerelse i Naturen," 1845, p. 76.

1. Female.
2. Male.
3. Androgynous.
4. Appendicular.

The female portion, as with Helix comprises the ovary, oviduct, albumen gland, uterus, and vagina. The ovary, unlike that of the snail,* is not a mere flattened expansion, almost inseparably united to the lobules of the liver; but is a thick, imperfectly egg-shaped, oblong gland, of a purplish brown colour, divided coarsely into three or four lobes, and these again into innumerable lobules, which project in every direction, being more loosely bound together than in Helix. It is situate beneath the final and posterior lobe of the liver, and immediately behind the stomach; it is bounded below by the musculo-cutaneous structure of the foot, upon which it lies almost freely, being merely attached to the inferior portion of the liver by loose filaments of connective tissue. It is three-quarters of an inch long, half an inch wide, and a quarter of an inch thick; but in the unimpregnated state it diminishes in bulk by about one-third of the whole. The lobules appear as small cavities, of an irregular spherical shape,—which seems due to compression,—these being filled with a transparent fluid, and numerous endoplasts, containing, granules. To each group of five or six lobules a slight branch of the oviduct is adherent; but it cannot be traced to any individual lobule, appearing, as it were, to become continuous with the connective tissue, which serves to connect them in bundles. In the anatomy of this organ I have been more than ever convinced of the error of H. Müller's view; for, if any second vesicle existed within the ovarian lobule, I could not have failed to detect it; yet nothing bearing the faintest resemblance to an included saccule could be discovered, nor have I detected the presence of zoosperms, although I have occasionally seen them in small numbers within the ovarian follicles of the snail. The ovary is provided with a tolerably large blood-vessel, one of the main branches of the superior division of the aorta; and the chief peculiarity of the circulation is this—the arterial vessel, having sent several branches to the gland, passes from it posteriorly, and is distributed to the terminal lobe of the liver. At the middle of the anterior inferior border of the egg-gland enters the oviduct, a delicate conduit, cylindrically tubular throughout, a little convoluted anteriorly, containing no second canal, which is very slightly larger at its uterine than its ovarian extremity, and is of a pearly-white colour. It is situated between ovary and uterus, being placed at first beneath the liver and stomach, but afterwards, assuming a superior position, it lies between the prostomach and duodenal bend of the intestine, the ovarian artery running beside it; and finally, about the middle of the body, it becomes confluent with the posterior portion of the uterus. It measures about

* See the author's Memoir on the Generative System of *H. aspersa*, Quarterly Journal of Microscopical Science, October, 1861.

two inches and a quarter in length; and in width, one-thirthieth of an inch behind, and one-twenty-fourth of an inch in front.

The albumen gland resembles that of the snail; it is, however, less compact, and also more linguæform than boat-shaped, and is usually of a yellowish-white aspect both externally and within. It is continuous anteriorly with the uterus, and it is not easy to discover a decided line of demarcation between the two, the albumen gland seeming but a solid continuation of the uterus, on which, moreover, it is folded back (when in its normal position), and retained, by almost gossamer folds of connective tissue. It lies, with the uterus, beneath the liver, and inferior to, and to the right of, the various folds of the intestine. In the impregnated individual it reaches a length of an inch, and a breadth of a quarter of an inch at its widest portion, for it tapers gradually in the posterior direction. Owing to the existence of several transverse divisions, it is resolved into many segments or lobules, each of which assumes a rudely-indicated wedge-shape, and is adherent internally along the inferior mesial line to a slender branchlet of the oviduct which traverses the gland from end to end. Microscopically, the anatomy is similar to that of Helix,—an enormous assemblage of albumen globules and fibres. I have never noticed any distinction, as regards opacity, between the component lobules of this gland, but on two occasions I have found that it was entirely absent.

The uterus may be regarded as the tubular prolongation of the albumen gland, which has just received the termination of the egg-duct. It is a vessel of considerable calibre, and of a pure, translucently white colour. It is thrown into about a hundred transverse folds, which give it, to an ordinary observer, the semblance of as many little pockets, lying side by side on a string, and which may be due to a shortening of one side of the tube, thus giving rise to a corrugated or plicated appearance on the other, by forcing it into a series of puckers. It is located between the white-of-egg gland and the vagina, to the latter of which its anterior end is conjoined, and it makes two or three serpentine windings in its passage from behind forwards. It is accompanied by a medium-sized artery, and has to its (as it seems) shortened border, the testicular follicles firmly adherent. It is placed in the purely abdominal region, and beneath the liver, gullet, and folds of the alimentary canal, lying more or less to the right side of the body, and retained *in situ* by various ligamentous filaments of connective tissue. When separated from its attachments, it is a little more than two and a quarter inches in length, whilst in calibre, at its widest part, and even when undistended by ova, it measures one-sixth of an inch. Structurally it has all the features of connective tissue, with a few nucleated fibres, which have the aspect of involuntary muscle. It is contracted anteriorly, and infundibuliform, and is carried on as a strong, straight, white duct, about half an inch long and one-twelfth of an inch wide, which I term the vagina. This, in its turn, opens into an expansion of the cloaca, for which I would propose the name of egg-sac, and of which I shall speak presently.

The male section of the generative system includes the testis, with the vas deferens and penis, which are virtually one and the same organ. The sperm-forming gland is a simple and prolonged structure, being constituted of a repetition of similar parts, each of which partakes of the follicular type; it is commonly of a whitish-yellow colour, and from this circumstance may at once be distinguished from the uterus, which otherwise might seem to careless observers to be part and parcel of it. Being strongly united to the shortened border of the uterus, it has the same position and relations as that vessel, and is of the same length, but in breadth it is not more than the one-twelfth of an inch at its widest point. It consists of a narrow duct, cæcal at its posterior extreme, which lies against the albumen gland, and free in front, where it is continued as vas deferens, to one side* of which is attached a collection of follicles, which secrete the sperm, and pour their contents into the excretory duct. Each follicle is of an ovato-lanceolate outline, the apex pointing outwards, and from its surfaces a great quantity of papillary elevations rise, which I fancy are lesser follicles; these giving to the whole gland a higher position organizationally than that of Helix: indeed, it is remarkable that two animals so very closely related zoologically, should exhibit such well-defined differences in the minute structure of their glandular mechanisms; here, however, as in the snail, I observed, on compressing a portion of a follicle, very many squamose and oval endoplasts occasionally nucleated. The testicular duct leaves the uterus as it passes into vagina, and is now called the vas deferens. This channel, I should think, has been wrongly designated; for although in other mollusks it is easy to trace the point of union between it and the penis, yet in Limax the one is so completely the prolongation of the other, that it is impossible to indicate, either the commencement of the penis, or the termination of the vas deferens. Hence this tube may be looked on as the penis; it is of a transparently white colour, a little wider in front than behind, and takes its course from the testicle posteriorly, to the generative outlet, in the following manner:—It first curves outwards and to the left, and then, turning in the opposite direction, approaches the right side of the body, passing over the uterus, and beneath the rectum; here, placed in the right lateral region, and covered by the membrane of the lung, it travels anteriorly as far as the cloaca, where, bending at an acute angle again below the rectum, it insinuates itself between the ovary and duct of the spermatheca, posterior to the latter; and finally, after lying beneath the aorta and above the egg-sac, it opens by a rounded aperture into the cloaca.

The androgynous division involves the sperm-sac and its duct. The former is a spherical expansion of the latter, with an exceedingly thin, transparent, and easily ruptured coat, upon the outer surface of which several arterial twigs ramify, producing, by the contrast be-

---

* This affords a well-marked contrast with the same organ in Helix, in which a double row of follicles is found. *Vide* Dublin Quarterly Journal of Science, April, 1861.

tween their white branches, and the transparent groundwork, a very beautiful appearance. I cannot imagine how Treviranus* could have supposed that this vesicle was an urinary organ; for, it has not the slightest connexion with the so-called kidney, and, on the other hand, is decidedly attached by its duct to the generative outlet; it is situate to the left of the uterus, by which it is embraced in its anterior fold, has the gullet below it, and is covered by the anterior lobe of the liver. In the unimpregnated individual it is empty, wrinkled, and triangular-shaped, with a length of five-sixteenths, and a breadth of a quarter of an inch, but, subsequent to coition, it is distended with semen (which, contrary to the assertion of Von Siebold,† is *not* at this period fully developed), assumes the globular form, and has a diameter a little over three-eighths of an inch. Its microscopic structure is that of connective tissue, simulating here and there a fibrillated constitution, which disappears under the influence of caustic potash, and having a few of the nucleated fusiform endoplasts of involuntary muscle. It empties its contents into the cloaca through the duct of the spermatheca; this is a strong and short canal, uniting the sac and outlet; starting from the former, it travels to the right beneath the aorta and uterus, and curving across the penis, with the egg-sac to its left, it communicates with the cloaca by a circular opening just beside the penis, and at its dextral border. It is about one-fourth of an inch long, and at its widest part measures one-twelfth of an inch in calibre.

The appendicular series embraces the egg-sac, and cloacal glands. The first is a conical papillary extension of the posterior portion of the outlet, its apex towards the left and front, and its base in the opposite direction; interiorly, it is hollow, and receives at its greatest diameter the orifice of the vagina, which projects into it, something in the manner of "prolapsus ani." I do not know that any function has been ascribed to this cavity; and in the absence of any other office, and from the fact that, during the deposition of the ova, each egg remains within it for some time, I would suggest that, it *may* serve to place the ovum in a position, to receive the attachment of the peculiar threads which connect the deposited ova. It measures three-eighths of an inch, or thereabouts, in length, and has a thickness varying between one-sixth and one-quarter of an inch; it is composed of muscular fibres and connective tissue blended together. The cloacal glands, so far as I am aware, have not been described, yet they are numerous and interesting, and deserve notice, because in Limax the multifid vesicles of the Helicidæ do not appear, and hence it is *likely* that, be the function of the vesicles what it may, it is here performed by these cloacal glands. They present, in their entirety to the naked eye, a purplish-brown, tripey pilose aspect, and surround densely the internal or abdominal surface of the cloaca, from its anterior extremity, to the egg-sac; their ducts pierce the cloacal walls, and may be seen externally (on the inner or non-abdominal

* Zeitscrift fur Physiologie I.

† Vergleichenden Anatomy.

side) as a cluster of minute apertures. If a thin carefully-prepared section be made with Valentin's knife, the following structures are observed: an immense quantity of dark follicles lying in indifferent tissue, and recalling at first sight the meibomian glandules of the eyelid. Each follicle is compound, being composed of a central stem or channel, which, as it passes toward the outer surface, sends off three or more lateral branches; and to the ends of each of these a dark, spherical, grape-like vesicle is united, which, when ruptured by compression, exhibits its contents as liquid matter, containing endoplasts and granules. The common generative outlet I have not yet described; for, as it belongs to no section in particular, so it could not have been referred to till the other regions had been disposed of. It is a very simple tube, divested of its glandular appendages; about one-fourth of an inch long, and as wide, when distended. Into its posterior part, open the penis, and spermatic duct. It is attached to the egg-sac behind; and in front, where it forms the generative aperture, which is closed by an elastic band, it is lost in the general integument.

The eggs of this creature are deposited during the months of August and September, usually under large stones, but seldom in the earth. They are about twenty or thirty in number, collected together by means of glutinous threads, which adhere to them. Each egg is spherical, and of an opaque white colour, measures about one-ninth of an inch in diameter, and consists of two coats, a quantity of albumen of a viscid character, and the yelk mass. The outer coat, and that in which the opacity is observed, appears glistening and granular under the microscope, when viewed by reflected light. When isolated, it is found to be exceedingly tough, and to be composed of some material having a fibrillated structure *apparently*, and embedding in its substance particles of carbonate of lime; for, when acted on by weak acetic acid, an effervescence results, and the opacity vanishes. The fibres of which it seems made up are not real, but due possibly to the wrinkling to which the membrane is exposed, in submitting it to examination; at all events, when a portion of it has been by careful manipulation flattened out, and allowed to remain for some time in caustic potash, the fibrillation disappears, and a clear structureless membrane remains. The inner coat is transparent, but presents the falsely fibred aspect of the outer one. The yelk is a yellowish mass, possessing the usually granular aspect, and built up of oil globules, grounded endoplasts, and coloured granules.

General Remarks.—In contrasting the reproductive apparatus of Limax with that of Helix, as regards position, form, and structure, we find that, while occupying pretty nearly the same place as that of Helix with relation to the viscera among which it lies, it presents many characters, morphologically and histologically, which were not observed in that of the latter genus. We miss here the dart-sac, multifid vesicle, flagellum, and spermatheca-cæcum, which were so fully developed in Helix. The first has no representative; the cloacal glands may be a substitute for

the second; and since it is probable that the third and fourth are mutual adaptations, the one owing its development to the requirements of the other, it follows that the non-development of the one is consequent upon the absence—teleologically—of the other. Here, too, we observe no cloacal valves, and from this, it is likely that the function which in a former memoir I attributed to these organs is not the *incorrect* one. It is not a little surprising that Moquin-Tandon, who has given a rude engraving of a portion of the reproductive apparatus, should have overlooked the glandular character of the outlet; and not less so that he should have represented the egg-sac as being of a crescentic form, and termed it the "horned appendage." Moreover, I can with difficulty imagine that he has ever seen the spermatic particles; for he figures these latter—as though he had been looking at tadpoles, or more probably at pictures of human semen,—with gigantic spherical heads; whereas actually they exhibit only an approach, and a very faint one, to a capital extreme, in the form of a little spiral coil. The testicular and uterine divisions of the generative system are supplied with blood by a lateral vessel, which passes from the vaginal end to the albumen gland, lying upon the border of the uterus, and transmitting numerous branches to this structure and the testis. With regard to the distinctness of the latter organ, I may state that its excretory duct is not the semi-canal which Prevost* took it for. I have, after a little manipulation, succeeded in isolating completely its lower or anterior end, together with its continuation—the penis. The retractor muscle of the intromittent canal is often absent, but when present, is a simple band arising from the integument above the foot.

It is almost impossible to describe the anatomical peculiarities of a creature so highly organized as that of Limax with the accuracy and perspicuity which is desirable; hence, doubtless, in the foregoing *very general* account there may, of course, be errors, not only in observation, but in induction. These (should they exist) it is hoped, shall soon be pointed out by others more skilled in the examination of molluscan organisms than the author; who can only add, in conclusion, that his sole object in the communication of these remarks has been the advancement of biologic science, by an effort to elucidate a subject, which seemed to him left too long in obscurity.

EXPLANATION OF PLATES.

Plate III.

Fig. 1. Lobule of the liver enlarged, showing the ducts continuous with the septa.

Fig. 2. Portion of the spinous membrane of the mouth, magnified.

---

* Ann. des Sci. Nat. xxx.

Fig. 3. Lobules of salivary gland, increased.

Fig. 4. Ganglionic endoplasts, much enlarged.

Fig. 5. Cluster of lobules, from ovary.

Fig. 6. Muscular strata of the gullet, exhibiting interblended fibres of elastic connective tissue.

Fig. 7. Diagrammatic section through head and gullet:—*m*, mouth; *p*, pharynx; *t*, tongue; *ϕ*, œsophagus.

Fig. 8. Plan of the arrangement of tentacular muscles:—*St*, superior tentacle; *It*, inferior do.; *B*, basal muscle; *PS*, posterior side of triangle; AS, anterior do., do.

Fig. 9. Schematic projection of nervous organs:—*Ph*, Pharyngeal ganglia; *a*, first circle; *b*, second do.; *c*, third do.; *Pe*, *Pe*, great pedal nerves.

Fig. 10. Vertical section through wall of cloaca, with peculiar gland-like organs embedded in homogeneous matrix.

Fig. 11. Single lobule of the testis, highly magnified.

Fig. 12. Diagram to illustrate course of circulation:—*H*, heart; *A*, aorta; *I*, intestine; *VC*, visceral chamber; *LV*, lateral vein and its branches; *L*, lung; *P*, pericardial gland; *S*, sinus or auricle.

PLATE IV.

Fig. 1. Outlinear sketch of digestive system:—*H*, head; *G*, *G*, gullet; *S*, *S*, salivary glands; *St*, stomach; *L*, *L*, liver; *I*, intestine.

Fig. 2. Outline view of generative system:—*O*, ovary; *OV*, oviduct; *A*, albumen gland; *u*, uterus; *T*, testis; *V*, vagina; *P*, penis; *SS*, sperm-sac; *ES*, egg-sac; *CE*, cloaca.

IV.—*On the Reduction of Iron by the Use of Condensed Peat, at Creevelea, County of Leitrim.* By R. H. SCOTT, M. A., Lecturer on Mineralogy in the Royal Dublin Society.

[Read on Monday Evening, November 17, 1862.]

MR. R. H. SCOTT exhibited a pig of cast iron, which had been recently manufactured at the Creevelea Iron Works, county of Leitrim, which are now under the management of Mr. George Murrall. This specimen derives its peculiar interest from the fact that the fuel used in its manufacture is turf, which has been "condensed," according to Mr. Buckland's patent. He said that his attention had been drawn to the subject by seeing the notices in "Saunders's News-Letter" of the 10th and 13th instant, respectively, of which the former ran as follows:—"The suc-

cess of the experiments lately made in the adaptation of peat fuel to the manufacture of iron will probably have considerable interest for such of our readers as have directed their attention to the development of this useful and economical process. That this will eventually prove complete there is abundant reason to anticipate, as Mr. Murrall, the manager of the Creevelea Iron Company, now reports that the process of smelting the iron ore with the condensed peat fuel has been successfully pursued for four days continuously—indeed, until the entire stock of fuel supplied for the purpose of the experiment had been consumed. Notwithstanding that a very inferior limestone has been employed as a flux, 25 cwt. of pig iron has been produced, whose quality is equal to the Swedish iron. A sample of the iron thus made (56lbs. weight) by the adaptation of peat fuel, together with specimens of cinders, peculiarly worth notice from their purity, may be seen at Simpson's Seed Warehouse, No. 1, College-green." He then continued:—Thinking that it might be of interest to exhibit this iron at the present meeting, I wrote to Mr. Murrall, who referred me to Mr. Joseph T. Potts, of Fitzwilliam-square, to whom I am indebted for the statement which I now lay before the Society. It will clearly be understood that for the facts which are therein contained the authorities whom I quote are alone responsible, and I abstain from making any comment on the process. It is as yet only an experiment at these works; and although it seems to be very promising, we must await the results of mechanical experiments on the metal before we can pronounce with certainty as to its quality. A short description of the district in which the furnace is situated may not be without interest to those who are not familiarly acquainted with the geology and topography of that part of Ireland. Creevelea is situated about four miles to the N. E. of Drumkeeran, in the county of Leitrim, and in its immediate neighbourhood are situated some of the coal-mines of that county. The district is, however, more remarkable for the enormous quantity of ironstone which is found throughout it in a state of very great purity. As to the statistics of the seams of coal, &c., to be found there, most valuable information is to be found in Sir R. Griffith's report on the Connaught coal-fields, published in the year 1818; and more recently a very important paper on the same subject was read before this Society by Mr. Buchan, and published in No. IX. of our Journal. I shall now proceed to quote from a report made by Mr. Joseph T. Potts, in September, 1861, when he made a survey of the locality. This gentleman has kindly furnished me with a map, which I have the pleasure of exhibiting, showing the respective positions of the works, the turf bog, and the iron levels:—"The works which are represented on the map were erected some ten years ago by a Scotch company, at a very large expense, for the purpose of smelting iron by means of coal; but, owing to the distance of the coal-fields from the works, and other reasons which are not explained, the place was abandoned, and is now in possession of the present company. This consists of a few gentlemen who are desirous of trying whether the manufacture of iron by the use

of condensed peat fuel could be carried on with advantage. It only requires a short inspection by the least practised eye to observe that the works which have been erected here are in excellent order, and more than sufficient for the most active operations. I therefore proceeded to examine the mountainous range, being desirous of ascertaining the proximity of the peat to the furnaces, its quality, and the best means for its conveyance to the works. The distance from the end of the 'made road,' marked in the map, to the level of the mountain is three-quarters of a mile, and its distance from the works is one mile and a quarter. There is clear evidence of an ample supply of ironstone all along the valley, with the vast plain of peat, sufficient, I should say, to supply the most active operations for centuries to come, the bogs varying in depth from five to seven feet. The least depth of bog on the ground over which I passed was three feet. On the extreme summit of the mountain the quality is fibrous for the first two feet, the next much less so, and the remainder hard and close. The proximity of both bogs to the made road below led me to the conclusion that very little expense would be incurred by delivering the peat down by a shoot or tramway, to be manufactured at the point marked in the map, from whence it could be brought to the works when fit for use." A brief account of the works was published by Mr. H. Coulter, the special correspondent of "Saunders's News-Letter," in the beginning of this year, in his letters from the West of Ireland, which have since been published in a separate form. At the time he wrote, it was proposed to bring down the turf from the bog on an endless chain. This plan has not, however, met with approval, and has been discontinued. The compressed peat fuel is made by a peculiar process, which has been patented by Mr. Buckland, and which was to be seen in operation in the International Exhibition. Mr. Brunton, who was the exhibiter, has furnished me with the following account of the apparatus and process:—"Immediately the peat is dug from the bog it is thrown or tipped into a hopper, beneath which is a strainer formed of perforated metal, and within the strainer is an Archimedean screw; at the bottom of the strainer is a small opening, through which any very coarse undecomposed roots and fibres, which will not pass through the perforations of the strainer, fall into a waste pipe and are rejected, or may be used for any purpose not requiring superior fuel. By turning the screw within the strainer, the small fibres are cut up by the sharp edges of the perforated metal, through which they pass with the decomposed part of the peat, with which they thus become assimilated. A strainer of two feet in diameter, with perforations of one-eighth of an inch diameter, and fifteen to the square inch, contains about 12,000 holes, which are equal to an aggregate aperture of a square foot; a strainer of this size will discharge about eight tons of peat per hour, or nearly one hundred tons in twelve hours. The decomposed peat protrudes through every hole in the strainer, and drops, in vermicular forms, upon an endless band, which delivers the strained peat into a brick machine, which will mould it in any suitable shape or size that may be preferred. The

strainer being closed in a heated chamber, with an opening for the escape of steam, the moisture is rapidly driven off from the worm-like strings as they fall upon the band, giving solidity to the moulded blocks of peat as they pass through the die of the brick machine; and their being then at a high temperature expedites the subsequent process of drying. Very little power is required for the whole operation, which is performed continuously, and with great rapidity. The moulded blocks of peat are removed to a drying shed, through which a current of hot, moist air passes; and they soon, without compression, become as hard as oak, and more dense than any peat submitted to hydraulic pressure, the specific gravity being from 1·15 to 1·50, and that of highly compressed peat 1·8. From four to five tons of wet peat, as taken from the bog, are required to make one ton of dry condensed peat, the total cost of which is about 3*s.* 6*d.* per ton. Peat thus prepared burns very freely, will stand a powerful blast, emits great heat, is smokeless, and produces less ash than the average of coal or coke. It is impervious to water, improves by keeping, and is incapable of self-ignition. From two and a-half to three tons of prepared peat will make one ton of excellent charcoal, the cost of which would be about 12*s.* per ton; but in converting the peat into charcoal, one cwt. of hydrocarbon or peat tar may be drawn from one ton of peat, the value of which for illuminating and lubricating purposes will greatly reduce, if not entirely cover, the cost of the charcoal." The peat, when it comes from the machine, is moulded into blocks of the shape of four-inch tiles, and is placed in trellised sheds, open at the sides, where it remains for some days. It is afterwards placed in a stove, and dried thoroughly. It is possible that improvements may hereafter be made in this drying process; and it is confidently asserted that the great difficulties which have been hitherto experienced will shortly be overcome, if, indeed, they have not already been surmounted. The peat with which this iron was smelted was charred, and stood the hot blast furnace in a way that surpassed the most sanguine expectations. This sample of iron is the first that has been produced in Ireland, and much credit is due to Mr. George Murrall, the company's manager, for his skill and perseverance in producing it.

I have received the following letter from Mr. Murrall on this subject:—

"*Creevelea Iron Works, Nov.* 15, 1862.

"SIR—Having been employed nearly the whole of my life in smelting pig iron in Staffordshire and South Wales, at iron works, the proprietors of which were particularly careful to produce iron of superior quality, I was selected by the Creevelea Iron Company, whose works are about fourteen miles from Sligo, to carry out the important experiment of smelting iron ore with peat, prepared by a simple process, which has recently been patented. It has long been well known that peat is a remarkably pure fuel, possessing all the elements for making iron of the best quality; the difficulty has been to get rid of all the water

in the peat, and to produce a sufficiently consolidated material to resist the blast requisite for smelting iron. This has hitherto been attempted by submitting the peat to violent pressure, but these attempts have been unsuccessful. The object has, however, been perfectly attained by the simple process above alluded to, and which is particularly described in the papers forwarded to you. Having prepared a quantity of peat in this mode, and charred it, I conducted my experiment in a cupola furnace, 22 feet high, 3 feet 6 across the boshes, reduced to 18 inches above the hearth. I should have preferred a much larger furnace, which would have presented fewer difficulties, but it was thought desirable to commence operations on a small scale. I pursued much the same course as I should have done if I had been working with coke, using unburnt limestone as a flux, except that my tuyeres were larger and the blast not so strong, with some few other variations during the process of the trial which were suggested by the working of the furnace. I passed the peat charcoal over a three-fourth inch screen, as smaller pieces would obstruct the blast. As soon as I had a few cwt. of melted iron in the hearth, I tapped the cupola, and ran out the iron. I was not a little pleased to find that the iron was of such a quality as I never made before, and equal to any charcoal iron I ever saw. I continued for 60 hours to tap the cupola every six hours, or thereabouts, and the ten successive casts were similar in quality. I send you a fair sample of the iron, which will speak for itself. Having myself made in my lifetime about 300,000 tons of good pig iron in Staffordshire and Wales, I feel confident in saying that such iron as I have now made with peat cannot be made with coal or coke. I consider it equal to any Russian or Swedish iron. I believe that the charred peat can be made on a large scale at a less cost than coke, and that more will not be required than is now used of coke to the ton of iron. It is impossible to estimate the benefit to this kingdom, and to Ireland especially, of following out the enterprise, of which I have been delighted to be made the humble pioneer.

"I have the honour to be, sir,
"Yours very obediently,
"GEORGE MURRALL."

The following letter from Mr. Anderson, who tested the Creevelea iron, had been received by Mr. Potts:—

"*Institution of Civil Engineers of Ireland,*
"40, *Trinity College, Dublin, Nov.* 15, 1862.

"DEAR SIR—The pig of Creevelea peat iron, tested in my works this afternoon, carried 14·177 lbs. at two feet span. Comparing this result with experiments on cast iron bars made by W. Fairbairn, and reducing the result to his standard, it appears that your raw pig is 7·0·0 below the strength of the best specimens, and 29·0·0 above the worst. I have no means of ascertaining the amount of increased

strength obtained by re-melting, but it is always considered to be considerable. The iron is soft, and works very nicely, presenting a very close grain. I shall cause a Scotch pig to be broken on Monday, in order to obtain a better comparison.

"I remain yours very truly,
"W. ANDERSON.

"*H. T. Potts, Esq.*"

The CHAIRMAN (MR. W. ANDREWS, M. R. I. A.) expressed himself much interested in the peat iron manufacture described by Mr. Scott, and said it would probably prove a matter of great importance to this country. Some years ago, he was frequently in the habit of going out in the Claddagh fishing boats, and he remembered that there was only one man who could make spears suitable for the capture of a certain species of ground shark, which was much pursued by the Claddagh men, and was valuable on account of the great quantity of oil that it produced. Spears made in Dublin and elsewhere were tried, but were invariably broken by the struggles of this powerful fish, which, when struck, ran a great way, and rolled itself on the bottom until it broke the implement. The spears made by the man to whom he alluded never broke, on account of the toughness of the iron; and he found on inquiry that they were forged by a person who kept a little smithy, and who used peat only in the process of manufacture.

DR. STEELE said it was a curious fact that a century ago, in the year 1764, the Royal Dublin Society offered two prizes for the manufacture of iron. The first was a prize of £80 for the making of the largest quantity of pig iron, not less than 25 tons weight, with a preparation of Irish pit coal, in imitation of wood charcoal, equally good as that made with wood charcoal, fit for being manufactured into tough bar iron, and which bar iron may be sold on the same terms as Swedish. The second was a prize of £20, for making the greatest quantity—not less than 5 tons—of tough bar iron with coke from coke pigs, equal in goodness to that made from pigs smelted with wood charcoal. No competitors came forward to compete for these prizes. It was gratifying to find that at the end of a century iron had been made in Ireland—not with coke, but with a preparation of Irish peat—which appeared to be of a very superior quality.

MR. WM. ANDERSON, C. E., stated that the result of an experiment which he had made that morning showed that the strength of the Creevelea iron was 40 per cent. over that of ordinary Scotch pig iron; and from what he had seen, he had no hesitation in saying that the Creevelea iron would far exceed any Scotch or English iron in strength. He had visited Creevelea, and could bear testimony to the fact that the works and machinery were in perfect working order. There was one feature peculiarly encouraging with respect to the manufacture of iron by means of peat:—the price of charcoal iron for the making of steel was at present £6 10*s*., whilst that of ordinary pig iron was only £3 2*s*. per ton. Now, as the iron produced by peat charcoal was equal to that obtained by the use of wood charcoal, he saw no reason why the managers of the Creevelea works should not adopt Bessemer's process, and convert their iron at once into steel. Even though the cost of the peat charcoal should turn out to be much higher than stated, yet the price which they would obtain for their steel would be such as to yield them a handsome profit.

MR. JAMES HAUGHTON said he remembered, when a young man, hearing that iron of the best quality had been manufactured in Ireland.

V. — *The Prevalence and Prevention of Diseases amongst Domestic Animals in Ireland.* By JOHN GAMGEE, Principal of the New Veterinary College, Edinburgh.

[Read on Saturday, December 13, 1862.]

THE subject to which I have to draw your attention this evening is so vast, that I cannot be expected to do more than state succinctly the general results of my inquiries into the diseases of animals in Ireland, and throw out hints as to the best means to be adopted for the prevention of these diseases, and the cultivation of Ireland's resources as a cattle-breeding and cattle-rearing country. I must premise, moreover, that I have paid Dublin this second visit, under a conviction that the intelligence of the age, our great necessities, and the nature of the frightful losses sustained amongst stock in the United Kingdom, must henceforward invest discussions on the questions I have to touch upon with an interest that should have been felt in them long since. The responsibilities of my position are, therefore, great—so great that I often think it has been an act of temerity on my part not to avoid them; not unfrequently have I experienced the feeling that the task was far beyond my powers; but I have great faith in the potent influence of a good cause, and during the last few months I have had many more attentive listeners to my arguments than in previous years. My object has been, and is, to show that the British Isles are favoured by nature amongst the healthiest parts of the world for the breeding and rearing of stock, and, however numerous their inhabitants, enough animal food can be produced on them for all their wants, and best when our stock is preserved from contact with the foreign importations which have cost this country hundreds of thousands annually, and have only served to spread disease, deteriorate our meat supplies, and increase the price of provisions.

I am not going to touch on this subject in the character of a conservative or a free-trader. I have nothing to do with politics, and in laying the bare unvarnished facts before the world, know that every man of sense, whatever may be his views as to the rules which should govern commercial intercourse between the different countries of the world, must admit that it is of the highest importance to protect the property of our people, to prevent an improvident waste of life and money, and to submit, as a choice of evils, to some interference with the freedom of the subject, whenever the doings of one man, or a few, are likely to injure the million.

We have allowed stockowners to think for themselves. We have not prevented them adopting any means they could devise to save themselves from loss. We have opened our markets to the foreign producers, and, as a reward for the whole, we find that meat is getting dearer and getting worse—that speculation has taken the place of certainty—and that

we must look in vain for any change for the better, unless we alter entirely the system on which our live-stock trade and our live-stock management are at present based.

It must not be thought that I purpose advocating any project adverse to the interests of the owners of stock. On the contrary, I know that the day is fast approaching when they will be the most active co-operators in a well-devised scheme for the preservation of the health of animals, though it is undoubtedly a fact that, without the aid of government or judicious combination of the people, no scheme for such a purpose can be efficient.

To pass from generalities to matters of detail, I must mention, that Ireland is by nature the most favoured of the divisions of the United Kingdom. It is the most remote from the vast continent over which cattle plagues spread occasionally with great rapidity; it has a distinct insular position, which affords it an opportunity to control its importations of stock. Its climate is moist and temperate, and its pastures are naturally sounder than those of either England or Scotland. Why, then, should Ireland suffer more than either?

There are two classes of diseases that I have more particularly to refer to, viz., epizootic and enzootic disorders,—those maladies that spread widely over Europe, and those that are peculiar to Ireland—to Irish soil and Irish climate.

The EPIZOOTIC DISORDERS, or cattle and sheep plagues, are traced invariably to the east. They spread entirely in the lines of communication established by war or trade between different countries. They are propagated by contagion, and by contagion alone. Local causes influence their spead; but a careful study of their many outbreaks in different countries demonstrates that the local causes consist chiefly in circumstances which render the spreading by contagion most certain. These diseases commit great ravages wherever they spread, and especially in countries like our own, where their nature is ignored, and no means adopted for their prevention. They are kept in check and totally prevented in some countries, either from the circumstance that breeding is exclusively carried on in them, or in virtue of wise laws, which serve to protect the home produce from foreign importations.

To illustrate these points, let us refer for a moment to the continent of Europe. Austria, Hungary, and Prussia, are in dangerous proximity to Russia, which, in its turn, suffers from the extraordinary prevalence of plagues in Asia. It is the southern or hottest part of Russia through which the epizootics of cattle and sheep principally spread. The dreaded steppe disease or cattle plague has repeatedly crossed the Russian, and especially the Russo-Polish frontiers, into the heart of Europe. The general wars of last century, and Napoleon's campaigns early in this, invariably led to frightful losses by the disease. These losses were chiefly sustained by the countries directly bordering on Russia; but every now and then the movements of troops, or of enterprising and unscrupulous cattle-dealers, have carried the disease as far west as Italy,

France, Belgium, Holland, Schleswig-Holstein, and Great Britain.—The British Isles suffered twice last century. They are now protected from invasions by that disease, but how? by the great vigilance of the governments of the countries which have so much reason to dread the malignant typhus. They have established strict quarantines; and if perchance the disease appears in any of their provinces in the vicinity of the Russian confines, the slaughter of diseased and infected animals, the strict supervision of the district, stopping importation, and indeed stopping all cattle fairs and markets in the infected province, speedily exterminates the disorder. The disease is very properly attacked as a contagious disorder, and a contagious disorder alone; and so convinced are the Prussian people of this fact, that when a suggestion to convey Polish cattle to Berlin in close waggons direct without keeping them in quarantine was entertained by government, memorials and remonstrances poured in upon the proper authorities, praying that, if such a scheme had been sanctioned, it should at once be abolished.

The contagious typhus has a short period of incubation; by quarantine it is possible to control its spread, and, thanks to that quarantine, I have not to-day to refer to any recent visitation of that disease in this country, or even to the chances, which are infinitesimally small, of its ever approaching us.

But if the contagious typhus is thus held in check in the east, pleuro-pneumonia is also held in check in the west. It is not in Holland, through which an active trade is kept up; it is not in Britain, where the traffic in diseased cattle has been annually increasing since 1842, that such a result is obtained. If we notice the progress of this disease in Prussia, Mecklenburg, Hanover, Belgium, Holland, and Schleswig-Holstein, we find it not pervading the breeding districts which are exporting for the supply of those who fatten for the butcher, but in the districts where stall-feeding is carried on—where extensive distilleries, sugar manufactories, starch makers, &c., supply a rich and even wholesome refuse for the feeding of stock bred elsewhere. The animals have been bought up by dealers, sold and resold, and no sooner are they in the feeders' hands than pleuro-pneumonia appears. Here they are usually inoculated, and with far better result than I believed before visiting those countries this year.

In Mecklenburg, Schleswig-Holstein, Oldenburg, and that group of Dutch islands included in the province of Zealand, as in various other parts I could mention, the disease appears in isolated spots. The governments of these countries at once proscribe the districts where the epizootic appears, and slaughter the diseased animals. In consequence of this they suffer very rarely and very little. The Dutch government attempted the same system in Friesland. This province was clear of pleuro-pneumonia until the port of Harlingen became a centre for the exportation of cattle to Britain. Friesland then began to import cattle, and imported disease. It has been said that it does not import cattle. The active traders in that province know well what it is to buy in the cheapest market, and sell in the dearest. They frequently make excur-

sions in quest of bargains, and especially search out diseased stocks, which may be sold in London at a sound price.

Holland imported last year—

From Hanover, ...	6055	head of	cattle.
,, Prussia, ...	6908	do.	do.
,, Belgium, ...	1827	do.	do.
,, Great Britain, ...	16	do.	do.
,, Japan, ...	6	do.	do.

A considerable number of these passed through Friesland. In truth, the importation, after the opening of the English ports in 1842, was so active in Friesland, that the local authorities there failed to stop the disease by slaughtering diseased animals. No sooner had they cleared one district than another was infected, and they communicated with the authorities in other provinces, to urge them to assist in checking the spread of the disorder. Nothing, however, has served to protect Friesland, as the cattle-dealers' operations are far too active now throughout the whole provinces. Why should Friesland have remained free from 1829 to 1842, during which time the provinces of Utrecht, South Holland, and even Gröningen suffered? It then produced far more than its own people wanted. It exported extensively eastward and southward; it did not import a single head of cattle yearly. Stock was cheaper than in the Rhine provinces, and the Friesland dealer availed himself of the markets in the latter. The state of things now is precisely reversed; and the once pure Friesland is the spot in the world, perhaps, most polluted by pleuro-pneumonia in cattle.

What Friesland is in Holland, we find Meath to be in Ireland, Fife in Scotland, and Norfolk in England. These are the large exporting counties for the meat trade, and they import largely to feed for the butcher.

Very similar remarks to those I have made regarding pleuro-pneumonia, apply also to the foot-and-mouth disease, or epizootic aphtha. I shall therefore refer to these diseases in Ireland together.

The province of Munster was the first to be visited by these diseases. It owes this to its ports in the south. I have made careful inquiries on the subject. Prior to the introduction of the new tariff, animals were frequently brought to this country for breeding purposes. A considerable number of Dutch cows were imported into Cork as early as 1839; and this was due to the desire on the part of an Irish gentleman, then minister at the Hague, I believe, to infuse some of the excellent Dutch blood amongst the cattle of Ireland. At that time pleuro-pneumonia and epizootic aphtha were raging abroad. The distillers in the neighbourhood of Rotterdam and Schiedam had carried these diseases to South Holland, and they had even passed into Zealand. It is not to be wondered at, then, that our first cargoes of live stock from that port injured us as they did. Through the port of Bristol the West of England was infected by cattle exported from this country,

though it is said that the diseases traversed the British Channel, owing to direct intercourse between England and France.

Investigations as to the prevalence of these contagious disorders in Munster, show that they have nearly deserted Clare, they rage in Cork, Limerick, Tipperary, and Waterford. Dairy stock in Limerick is annually destroyed by these diseases to a large extent, and owing to the weekly and monthly purchases to keep up the supply of animals for the supply of milk. One gentleman alone lost 37 cows in 1853, 18 in 1855, 20 in 1860, and 30 in 1862, out of a stock never exceeding 200 head. This is one of many instances equally startling. County Cork, that was first affected, and has always suffered severely since, affords us excellent examples of special breeding districts or breeding farms, which have never been visited by the disorder, or which have suffered but once, and that owing to the purchase of diseased stock. I have had interesting interviews with some of the most intelligent stock-owners in that fertile county, and nothing can be more satisfactory than the experience they adduce, demonstrating the origin and cause of the persistent prevalence of pleuro-pneumonia amongst them. If they breed, they escape; if they buy, they suffer.

This year has been a very trying one, and many of the farmers in Connaught can testify to this fact. In that province we must not look to Leitrim, Mayo, or Sligo, for the greatest prevalence of pleuro-pneumonia and the foot-and-mouth disease. Roscommon is also, to a certain extent, a privileged county, but Galway has been a great sufferer. Such fairs as those held at Ballinasloe concentrate to one spot a people engaged in cattle-dealing. Hosts of jobbers are about the country, driving animals of all kinds, and disseminating disease. The mortality amongst cattle in Connaught varies as much as from one per cent. in breeding districts to eight per cent. where there is active dealing. Some of the healthiest districts are in Mayo and Roscommon. On the whole, however, Connaught is healthier than Munster, and it contrasts favourably, also, with Leinster.

The stock-owners of counties Carlow, Kilkenny, Longford, Wicklow, and Queen's County, have not, however, the yearly losses to record by contagious disorders that interfere much with the graziers and stall-feeders of Kildare, King's County, Louth, Meath, and Dublin. Dublin has suffered more severely and constantly than any other part of Ireland. This city supplies us with the same facts that may be obtained in any of the large towns of Britain. Cowfeeders own stocks that are dying off, or slaughtered diseased, at the rate of 60 or 70 per cent. annually. I never heard more startling revelations than those made by some of the Dublin cowfeeders, when I was here in the summer. I visited the Phœnix Park, and saw the wretchedly diseased condition of the animals found amongst town cows, though breathing the fresh air, and grazing on good pasture. In Dublin the cows are turned out during the summer. They are not, as in Edinburgh and elsewhere, kept constantly tied up; and yet the Dublin people have to devour, annually, many hundreds of these animals, victims of the ever-raging

pleuro-pneumonia. Many of the dairymen, keeping from twenty-eight to thirty cows, assured me that their annual loss amounted at least to £100 per annum, and often as high as £200, notwithstanding that they sold all their diseased animals to the butcher, at prices varying from £2 to £5. I visited the filthy and close slaughter-houses in the crowded districts of this city, and saw dozens of animals slaughtered diseased. Lungs of cattle affected with pleuro-pneumonia could be collected by the score. In one yard I saw ten head of cattle, nine of which were suffering severely from pleuro-pneumonia. Some of these were from the Dublin dairies, but large numbers had been purchased in the Dublin market, to which they had been sent by farmers in this and adjoining counties.

I saw the dairymen squeezing pus and blood into their pails, as they moved about milking their diseased cows, and was rather consoled by their statement that of late years much less milk was drunk in Dublin in proportion to the population than formerly. The poor people's children could indulge in goblets of cheap and wholesome milk twenty-five years ago, but the rich must pay much to obtain a little and bad at present. This state of matters is not restricted to Dublin; and I have insisted for a long time on the fact, that our infant population in large cities must be seriously injured by the milk supplied for it. Indeed, I know that the milk of town cows is rendered unwholesome and poisonous by the prevailing epizootic, the foot-and-mouth disease.

To return, however, to the prevalence of disease in agricultural districts, I must revert to the fact that the extensive graziers of Leinster—those who fatten cattle for the Dublin and English markets—those who own the finest stock in this country—who only get stock when it has attained the maturity to which it is permitted to arrive prior to a final preparation for slaughter—are the persons who now relate sad tales of destruction by contagious maladies. Their experience proves that, if they were prevented supplying our people with diseased meat, they must be ruined—that, buying constantly, as they do, in the largest markets, they must sell out their diseased stock to the greatest advantage, and ship a great portion of it to Great Britain. This practice is the great curse of the country—the immediate cause of the loss of thousands upon thousands to the farming community.

I have yet to allude to Ulster. It affords as striking an illustration as the other provinces of the presence of pleuro-pneumonia and epizootic aphtha near the busiest centres of the cattle trade, and their absence in the breeding counties or districts. Travel County Cavan and you fail to find contagious disorders, except in a few isolated spots, and very rarely. Cattle are there bred and disposed of as two-year-olds. The very stock that dies in the hands of the Meath farmers lives on healthy in Cavan—and why? Before the Meath farmer gets it, it has to travel, it has to pass through the hands of dealers, and through many markets. It cannot escape such an ordeal, and a few days or weeks after passing into the hands of its last owners, prior to being slaughtered, it proves infected with diseases caught in the short journey from Cavan to Meath.

The counties Monaghan, Tyrone, and Donegal are far more free than the eastern section of Ulster. There is a singular and very significant observation that I have made with regard to Antrim and Londonderry. The neighbourhoods of Belfast and Derry have been frequently visited by pleuro-pneumonia. The neighbourhood of Derry especially has suffered severely. It suffered very early. Shortly after pleuro-pneumonia had appeared in Cork and Dublin, some cattle from Glasgow carried the disease to the far north. This contagion led to the disorder appearing in districts remote from each other, at extreme parts of the country, almost at one and the same time. If Antrim is surveyed in search of contagious diseases, we find a large extent of country as free as Cavan. It produces cattle for elsewhere, and does not require to buy. Where it does buy and sell much, viz., in its southern portion, contagious diseases break out.

I might be tempted to enter into greater details, but I would occupy your time much longer than I can in reason wish. I must mention, however, that contagious diseases in Ireland induce annually quite 50 per cent. of the total losses by disease. In some of the districts I have referred to, fully 70 or 80 per cent. of the total of deaths result from pleuro-pneumonia. These contagious diseases are kept up by the trade in diseased animals, by the farmers purchasing calves from dairies in town and elsewhere impregnated with disease, and also by a considerable yearly importation of calves from the great centres of disease, viz., the dairies of Liverpool, Manchester, Birmingham, Bristol, and elsewhere. Persons engaged in the cattle trade have assured me in Dublin that the foot-and-mouth disease was introduced this year and last entirely by diseased calves. These animals are born where the atmosphere is constantly poisoned by the presence of diseased cattle, they are then much ill-used, brought across the Irish Channel, and sold in the Dublin market. It is to the interest of the Irish stockowner that the importations from Britain should be narrowly watched; and I believe that, with great care, a system might be devised to render the spread of contagious disorders from Great Britain to Ireland extremely difficult. Ireland could be cleared in two years of these contagious diseases, and this without molesting the stockowner, but, on the contrary, materially assisting him in the development of the resources of the land he cultivates.

I must not omit to mention, that the Irish farmer who sends his diseased animals to England, contaminates the very vessels and railway trucks in which he has them transported, and must expect to receive back the produce of the virus he has helped to disseminate.

But if I have given the epizootic or contagious disorders a prominent place in this paper, I feel that the importance of the study of Enzootic Disorders must be of more permanent interest. The day must come, and is fast approaching, when science and capital will be devoted to the prevention of plagues. That day is more distant when we shall cease to hear of dozens and hundreds of animals dying in various directions from

causes that are purely local, and that lead to the development in districts of diseases that do not spread beyond the soil of their spontaneous origin. It is in this department of study that veterinary science can permanently aid agriculture; that original investigations are needed to determine where animals should be bred, where they should only be grazed or fed, when they have attained maturity, when they should be supplied with artificial foods, or not allowed indiscriminate range over the most luxuriant pasture.

If within the last twenty years contagious diseases have been very rife, during that period the extermination of some enzootic disorders has been observed, owing to improvements in agriculture, and especially to the extensive and thorough drainage of land. But the forcing system, on the other hand, has led to the development of diseases of a different and very fatal nature, which occur here and there quite unexpectedly, and sap the resources of the country as much as they puzzle the suffering farmer.

Widely disseminated over the world, we have soils which are fertile, but damp, on which the rearing of young stock is always attended with great danger. The disease developed in these soils is the anthrax, or carbuncular fever of Continental authors; the black-leg, or quarter-ill of this country. In every climate the disease appears. It has been observed in the Polar regions, as in Lapland and Siberia; it prevails also in the temperate and tropical zones. I find in Ireland and in Scotland that it is chiefly witnessed in valleys along the base of mountains, where the pastures are rich but damp, the soils stiff and retentive. It is, however, seen on the highest portions of the Grampians and Pentland Hills, on the mountains of Wicklow and Mourne, as in those of Kerry. Donegal, and Mayo.

The countries in which human beings are most subject to ague, are also those in which the quarter-ill of cattle is most malignant; and though this disease prevails widely in the Three Kingdoms, we find it far more dangerous and destructive in Southern Europe. During the progress of the disease there the development of an animal poison is noticed, capable of inducing the malady in all warm-blooded animals, and malignant pustule in man. The virus develops in some countries, such as our own or France, only in the warmer months, and more rarely in the coldest and driest districts, in which the disease can appear. Closely allied to black-quarter, and belonging to the class of carbuncular affections, according to Continental authors, we have the fatal braxy of sheep; the destructive hog cholera, or blue sickness; the blain, or glossanthrax of cattle. Though these diseases prevail to a frightful extent in Ireland, and especially the hog cholera and black-quarter, they are more easily prevented here than on the majority of soils. There are no vast marshes or fens, the bogs are, for one reason or other, not insalubrious, and we find that, generally, animals must be predisposed to disease by being badly kept in winter, and then suddenly changed from bare to luxuriant pastures, in order to develop the malady. A judicious system of management would certainly put a stop to quarter-ill

and the hog cholera wherever they appear. They are diseases which prevail extensively in Munster. The hog cholera devastates more or less every county in that province, and losses of 20, 30, 50, and 80 per cent. have been reported to me by many. Black-quarter is also rife. It is rare in the lightest and most porous soils of Tipperary, and is not so common in Waterford or Cork as in Clare, Limerick, and Kerry.

In Connaught black-quarter is very prevalent. The hog cholera not so bad as in Munster.

Black-quarter prevails somewhat in Leinster, where the pig distemper is as rife as in Munster. The Ulster farmers also report the frequent appearance of both diseases.

These maladies are therefore more generally distributed over the land than the contagious diseases, and more than any other enzootic disorder. Thousands of diseased pigs are annually sold to ham and bacon factors, and from the red or purple colour of their blotched skins are called 'red soldiers.' I need scarcely say, that the Irish manufacturers of these delicacies are anxious to lead the public to believe that none but healthy pigs fall under their knives, and hundreds of diseased hams may be seen exposed for sale stamped "Prime York,' whereas no such disease exists in Yorkshire as the one so destructive amongst the Irish pigs.

I shall not detain you by special reference to such diseases as red-water or blood murrain, the dry murrain, &c. &c., which are very generally distributed over the whole country. I have to notice, however, that in districts where black-quarter once destroyed many yearlings there is now splenic apoplexy. It is a disorder incidental to plethora or fulness of blood, attacking animals that are being fattened for the butcher, and destroying the majority of such animals when it appears on a farm. One farmer in County Meath told me that he lost many cattle to which he was allowing 4 stone of mangolds and 14 lbs. of artificial food daily. This farmer also said that Dublin was close at hand for the diseased stock to be sent to. I have known a large number of animals, seized with this very fatal disease, sent forthwith to butchers in large towns; but within the last two or three years we have discovered that the flesh of these animals is very unwholesome. One of my students reported, in 1860, that a pig, having eaten of the abdominal contents of a cow that had died of splenic apoplexy, was seized with symptoms of a putrid fever, and died. This year I had occasion to publish a report from Mr. Aris, of Wellingborough, in which he said, "Pigs die rapidly after eating any of the offal of the diseased animals. I attended a very valuable mare which had died with all the symptoms of the disease, and she had been employed to draw one or two dead carcases out of the yard. I have great reason to believe she became infected from the diseased animals." Professor Simonds also this year witnessed similar accidents from the blood of cattle suffering from splenic apoplexy having been thrown into a yard where pigs ate it, and died. Dogs were affected in a similar manner. These observations are confirmed by those of

many Continental veterinarians, and I think all will admit that we should not suffer the carcases of animals to be sold as human food, when the blood of these animals can poison pigs and dogs. The disease is one that can be entirely prevented, and the losses need not be severe if professional aid is sought when the malady first breaks out on a farm. Preventive measures must be adopted, as, when the symptoms of the disease appear on an animal, death is almost a certain result.

Splenic apoplexy, like black-quarter, seizes the finest animals of a herd, and lays them low in from four to twenty-four hours. The French express themselves very appropriately when they say, "Les animaux paraissent foudroyés."

The change, then, in the nature of our enzootic diseases bids us be more careful than we have been in permitting an unrestricted traffic in diseased meat.

I shall not attempt to say much concerning the diseases of sheep. The rot, so prevalent in county Clare, also witnessed in Galway, that has even attacked cattle in Kilkenny this season, destroys not less than four or five per cent. of the total sheep stock of this country. There are sound lands on which the rotten sheep purchased at the large fairs are taken, and serious losses are incurred by farmers. Any one having grass on which he wishes to place sheep for a certain time, purchases in Ballinasloe or elsewhere, and finds that an apparently vigorous flock wastes on the best keep, and must be disposed of diseased. Not a few of the Meath farmers can record examples of this description.

Sturdy, foot-rot, and red-water, or blood-disease in high-fed sheep, swell the mortality lists. They are all diseases that can be prevented with a little attention, and by following out rules which a knowledge of their nature has enabled us to establish.

I have noticed the hog cholera, that dreaded distemper which has raged this season, and for many years past, with the intensity of a plague; but in its influence on the human health, the malady well known in Ireland by the name of measles, is far more injurious. It is essentially a disorder of this division of the United Kingdom. It is unknown in Scotland and England in the widespread form it prevails here. But it must not be supposed that the disease has not undergone changes with improvements in agriculture. In some parts of Ireland measles has been on the decline; in others, it has remained stationary. It has been exterminated in those districts and counties where farmers rear large numbers of pigs on wholesome farm-produce, and keep them amongst the animals of the farm-yard. If, however, we go through Tipperary, Limerick, portions of Cork, and other counties, we see swine living with human beings. They enjoy freedom around the cottage, of which, according to an old Irish saying, they are the real tenants. They devour all filth, and, amongst other matters, human excrement. They swallow the ripe joints of tape-worms, and the ova of these develop into the *Cysticercus cellulosæ*, the measles found in thousands distributed over the whole muscular structures of the pig.

So thoroughly has the system of utilizing diseased flesh as human

food become established in this country, that respectable firms employ "measle-triers" to detect the measly pigs out of a lot bought in market, so as to claim a reduction on them. They cure them, and sell them at the small reduction of 3*s.* a flitch. From the open condition of the textures of these diseased animals, they pickle well, they are never tainted, and English bacon-dealers apply regularly for measly bales of bacon. Let it not be supposed that these parasites are destroyed by the pickling process. Fortunately, myriads of them are destroyed in the process of cooking; but unfortunately there are many people, far more than any non-professional person would imagine, who acquire a morbid taste for underdone or raw food, especially pork, whether pickled or otherwise, and they rarely to fail to suffer in consequence. A gentleman having great experience in the bacon trade assured me that when the famine in Ireland stopped the supply of pigs for the English bacon factories, and they had to buy English pigs, they found no measles. It was rare to meet with a measly pig. They invariably got animals thus diseased from Ireland. Many of you here will have greater experience than myself regarding the districts where pigs are kept singly by the poor, and where they are chiefly enclosed in farm-yards. As a rule, measles will be found to prevail in the first, and not in the second. Is it not frightful that three per cent. of the Irish pigs should be affected with this loathsome disease?

I am led now to lay before you some statistical facts. That they are facts, you must accept this evening on my word, as I cannot enter into a statement of how they have been collected and calculated. They have been chiefly obtained from farmers, from cattle insurance agents, from my own personal inquiries, in different parts of Ireland; and I am deeply indebted to the assistance of Dr. Kirkpatrick of Glasnevin, without whose exertions I could never have met you this evening, supplied with much of the information I have laid before you.

The mortality amongst cattle in Ireland varies from two per cent. in a few districts, to 12 per cent. in others. The average over Ireland is never less than 5, and some years exceeding 7. This is the loss by fatal diseases; but, as all farmers are aware, a heavy loss is incurred annually by maladies which do not kill, but which deteriorate the condition of stock, and lead to greater loss of time and food. This is the case when the epizootic aphtha prevails, as it has done of late. This loss cannot be calculated at less than one per cent.; so that I am sure that I am not overstating the yearly loss, when I declare that it attains in Ireland, from all causes, six per cent. The last return shows that there are 3,250,396 head of cattle in Ireland, of which, therefore, there is a loss in round numbers, of 195,024. A very careful study of the losses in cattle has led me to determine that it is the best stock that is destroyed, so that it is fair to calculate the value of the animals lost at the average value of the total stock. Mr. Donnelly's valuation of £6 10*s.* a head is not a correct one. It is very much below the real average value; nevertheless, even accepting that the lost animals are on an average not worth more, Ireland loses £1,267,656 annually by losses

amongst cattle alone. We are far nearer the mark if we value the dairy, grazing, and stall-fed stock, amongst which the largest amount of loss is sustained, at £12 per head, and that gives a total loss of £2,340,288. Of that loss in this country, 60 per cent. is the result at present of contagious disorders.

The average loss on sheep, over the whole country, is not less than one per score; it often exceeds this. The loss in money amounts to £190,173.

The lowest estimate I can make of the mortality amongst pigs in Ireland is 10 per cent. Were I to listen to the statement of losses amounting to 50 and 60 per cent. over wide districts, I would have to double that estimate. But, on the most moderate calculation, Ireland loses annually, in round numbers, 150,000 pigs, amounting in value to £187,500. Taking the Registrar-General's calculation of the value of the stock of the country, viz., £31,204,325, we have an annual loss on it of £1,645,329. I consider this to be far below reality; and if we take my valuation of the cattle at £12 a head, the annual loss amounts to £2,718,961.

I have no doubt there are those who will think that there must be some mistake in all this; but any one devoting himself to the collection of statistics on the subject will find that I am much below instead of above the real loss which Ireland annually sustains from disease amongst cattle.

If any man of sense ponders over this subject, he must be driven to the conclusion, that to live in ignorance of facts such as I have here brought out is culpable; and, when the real state of things is known, it can only be regarded as a great act of negligence and improvidence, that men of talent and industry should not devote their time to the institution of a system which would be the best guarantee against the recurrence of famine, and would tend rapidly to increase the wealth of the country.

I unhesitatingly affirm that 50 per cent. of the loss I have alluded to could be saved within a couple of years of the active working of a scheme intelligently framed for the prevention of disease. The working of such a scheme, though expensive, would amount to a mere trifle in comparison with the loss. Recent calculations would indicate that the expenditure would amount to about 2 per cent. on the smallest estimate of annual losses.

How such a scheme is to be worked out, it is at present premature to say. I am anxious that the evil existing should be exposed; that, instead of permitting a system adopted as the best of bad ones by the farmers to keep all secret, we should have everything open and above board. No enemy is more dangerous than one that is invisible. At present the general impression is that there is no serious cause for taking into consideration the losses resulting from disease in stock. These losses are not recognised as they should, as exerting a great and bad influence on the nation; and the capitalists who swell the mass of diseased meat sold to the public, by disposing, when occasion requires, of their diseased stock, are individually desirous that this vast subject should not be

broached. When the potato crop fails, the peasant's family is deprived of its humble but sufficient meal. The starving poor appeal to our sympathies, and the whole kingdom is anxious to find a remedy for such a disaster. But if Ireland does lose between two and three millions sterling annually by disease in cattle, the poor are affected indirectly, though with equal certainty. The real cause lies hidden, and escapes observation. No effort is made to counteract it. Prevent that loss, and you will soon find the yearly decrease in the production of stock converted into a decided increase. The farmer's income will be augmented, the labourers employed will be in greater number, and the landlord's rent paid with regularity.

This great question concerns government, as it involves the protection of the best property we have—the produce of our fertile toil. Past governments have unwittingly led to a deterioration in the value of that produce. Free trade in stock has been an experiment which has injured every country that has tried it, unless regulated by laws based on a thorough knowledge of the nature of contagious disorders.

Let the public state, in unmistakable terms, that it wishes wholesome food for its honestly acquired gold—let the farmer plainly assert that he must be ruined, unless he be permitted to dispose of his diseased stock to the butcher; and, with these points clearly before us, the remedy can be applied.

It is a remedy that has been most successful elsewhere, and it consists in applying veterinary knowledge to the prevention, rather than to the cure, of disease—in having able men to investigate at any moment the causes of mortality amongst stock; and, fortunately for us all, the diseases of the lower animals are simple in their nature, and their prevention is certain.

My suggestion, therefore, is, that the public should manifest an interest in the matter, combine, if you like, and show a readiness to assist government in any scheme sufficient to meet the evil, provided that scheme be for the good of all. If you are incredulous as to the possibility of preventing all the diseases I have alluded to, hesitate not to prosecute inquiries, to attempt experiments, and then aid in suggesting good measures, if others propose bad ones. I invite you not to be deceived by the treacherous appearance of the surface of things. Face manfully an inquiry into the whole subject, and do this with a determination to further, by all means in your power, the interests of the farmer and of the general public. I do believe that the highly educated and intelligent men likely to influence our government in these matters will do so in a manner calculated to effect much good; but in this country, fortunately, the voice of the people is listened to; and I sincerely trust that after these few words of caution, the feeling manifested by the agricultural community will be in favour of an uncompromising attitude against all who seek to blind themselves and others to the realities of the case, and are inclined to let matters take their course as for the past. I am not an advocate for coercive measures. I want to work out a remedy. That re-

medy is discovered so soon as you have established the nature of prevailing diseases and their causes.

Any scheme adopted must aim at suppressing the traffic in diseased animals and the sale of diseased meat, affording advice to the stockowners when disease appears, and studying carefully all the facts relating to the prevalence and causes of enzootic disorders, with a view to suggest preventives. The stockowner must and can be protected by timely advice and co-operation. It would be absurd to say to him, we care not if you are ruined, but we shall not permit you to sell your diseased animals. This would materially tend to increase the yearly deficiency in the breeding of stock, which it is so important should increase in proportion to our wants.

LORD TALBOT DE MALAHIDE, V. P. (Chairman), said it was impossible to overrate the importance of the subject, or bestow too much praise on the ability with which it had been treated. He took a great interest in the rearing of stock, and therefore hoped that those gentlemen who were acquainted with the subject would favour the meeting with the results of their experience, and he was sure Professor Gamgee would be ready to answer any questions put to him.

MR. JAMES GANLEY, salesmaster, said that beyond all doubt the disease called pleuro-pneumonia existed to a very large extent in Ireland, and the great question was how to prevent it. He would take this public opportunity of stating that unless some means were devised to give compensation to the farmer for his diseased cattle, it was impossible to prevent him from selling them, or the butcher from buying them or killing them. Unless some society were formed with a view to have diseased stock destroyed, it would be sold and bought, and killed and eaten. As there was no use in mincing the matter, he would say for himself and his brother salesmen, that every one of them sold diseased cattle. The farmer had no remedy; he should sell his unsound as well as his sound stock, to enable him to pay his rent; for the disease was so prevalent, that he could not live were he to submit his cattle to destruction without some payment for them. Some one might ask why did not the Corporation prevent this state of things? His answer was, that the Corporation did not prevent it; and so long as there was no remedy offered, they would be obliged to sell diseased stock, and the butcher would buy them.

THE HON. JOHN P. VEREKER (the Lord Mayor Elect) said, that he thought this country laboured under a great disadvantage in not having spread over it a number of veterinary surgeons of Professor Gamgee's ability and experience. He regretted that efforts which he and other gentlemen—anxious to promote the prosperity of Ireland—had made some time since to found a Veterinary College in Dublin, had heretofore failed; and the Irish student who wished to obtain the diploma of a college had now to go to London or Edinburgh. He regretted that he could not agree with the suggestion of the last speaker, namely, that all diseased cattle should be slaughtered, and that Government should compensate the farmer for the loss sustained. The effect of such a system would be to spread disease enormously, not to check it. Experience taught us that when the Government of the country came to purchase anything, they paid, as a general rule, more for it than its intrinsic value. If, under this state of things, a farmer had bad or unsaleable cattle on hands, it would be his interest to expose them to contagion; for it would be easier and more remunerative to get compensation for a diseased carcase from the Government, than to send badly-conditioned, though healthy stock, to a distant or uncertain market. Under the present state of things, a farmer was compelled by the strong motives of self-interest to send at great expense to healthy and perhaps remote districts to purchase sound stock, and it was for the benefit of the community that this practice should prevail; but if the Government undertook to pay for all losses by disease,

the farmer would, of course, send to the cheapest and nearest market,—sure that he could not lose by the spread of disease, or rather sure of reaping unusual profits from what good policy ought to teach him to regard as a serious calamity. Self-interest would teach him to court, and not to fly from, contagious cattle diseases. It was impossible to listen to the Professor's able address without being satisfied that well-considered legislation was loudly called for to enable us to arrest the spread of contagion among cattle. At present the law was most defective. He would give one example. The Lord Mayor of Dublin had the power to seize diseased meat when exposed for sale, and he sometimes sent large quantities of it to the Zoological Gardens; but it was very difficult to find out the diseased meat once the animal was slaughtered, inasmuch as it was generally cut up in small pieces difficult to discover, or concealed, and was often cured, or manufactured into sausages, before it could be seized. But the Lord Mayor had no general power to seize the animal before it was slaughtered, although he saw it driven through the crowded markets, spreading disease on every side among the cattle exposed for sale, and destined when slaughtered to poison the poor with its dangerous and disgusting flesh. When the *variola ovina*, or sheep-pox, first appeared in 1848, a tempory Act was passed authorizing the seizure of sheep and cattle. But this Act only extended to the above-mentioned disease, or to diseases of a like nature. A clause could easily be added to the "Dublin Improvement Act," and indeed a similar clause should be added to the "Towns' Improvement Act," enabling the authorities not only to seize all diseased fish, meat, &c., exposed for sale, but also to seize all animals introduced into a fair or market-town while labouring under any infectious diseases.

Mr. James Haughton said that the paper should be deeply interesting to his carnivorous friends; but he thought they might not be so much concerned about the matter were they to become vegetarians, as he had several years ago, without having any reason to regret the change. It was said that Ireland was peculiarly fitted for the production of cattle; but his opinion was, that if proprietors were to direct their attention to the cultivation of corn, both they and the country would be far better off. They had difficulty at present in sustaining the population of the country; and if agriculturists were to care less for the production of cattle, and more for the production of corn, they would enable the country to support at least three times its present population.

Mr. Charles William Hamilton could not omit the opportunity of expressing his conviction of the great service which Professor Gamgee has rendered them all by the address which had just been delivered. The picture which the learned Professor had drawn, though frightful indeed, was not by any means overdrawn, as he could bear testimony to the difficulty experienced in arriving at the facts in such cases, where it appeared to be the farmer's interest to keep back information as to the real condition of his stock. The ravages committed by the disease might be inferred from the circumstance of the diminished numbers of animals which appear in the great metropolitan market, notwithstanding the increase of population and the considerable importations of stock from the Continent. Comparing the returns for the years 1858 and 1861, there was a falling off in the number of cattle of 10,045 head; and of sheep the falling off, between 1851 and 1861, was 170,525, although the metropolis had in the interim increased one-fifth. But when we take into account that this decrease is coexistent with a wonderful improvement in the rearing of stock, as regards early maturity, the diminution in the live stock of the country will appear still more frightful. As a consequence of this state of affairs, the prices of butchers' meat have very much increased of late. In the last ten years, the rise in the price of beef has been from 3*s*. 8*d*. to 4*s*. 10*d*., and of mutton from 4*s*. 2*d*. to 5*s*. 8*d*., per 8 lbs. These were startling facts in connexion with the able statement which they had from Professor Gamgee, and they were surely such as could not fail to lead to energetic action to arrest the evil which had now become of such appalling magnitude.

Charles A. Cameron, M.D., said he had listened with great interest to Professor Gamgee's admirable paper, which, as the production of so eminent a veterinarian as the Professor, could not have failed in proving most interesting and instructive. Professor Gamgee would, however, he trusted, not consider him (Dr. C.) impertinent if he compared him to a favourite singer, who always reserved a choice *morceau* for an *encore*.

Numerous questions would, no doubt, be put to the Professor, and, in replying to them, he would, perhaps, by way of an *encore*, point out a remedy for the dreadful evils which he had so graphically and truthfully depicted. As Professor Gamgee stated that pleuro-pneumonia was communicated by contagion, and was never of sporadic origin, he would, no doubt, suggest a strict quarantine; but he (Dr. C.) feared that a quarantine could never be strict enough to be an effectual preventive. If the disease did not occasionally break out spontaneously, how was it that two or three years ago pleuro-pneumonia appeared in several districts in Australia, and carried off many thousand animals? If the disease had been introduced from Europe—if animals could make a voyage of 16,000 miles, land in a state of health, and yet carry the virus with them, it proved that the strictest quarantine could not prevent the introduction of tainted animals into these countries. That pleuro-pneumonia was occasionally of spontaneous origin, appeared to him (Dr. C.), from the nature of the disease, probable enough; he knew of a case which favoured this supposition—it was that of a number of cows dying of pleuro-pneumonia on an island near the west coast of Ireland, into which no cattle had been imported for two preceding years. He could not explain this circumstance according to Professor Gamgee's theory; but as he (Dr. C.) was not a veterinarian, he would not venture to put his opinion in opposition to that of Mr. Gamgee. Dr. Cameron, in conclusion, said that Mr. Gamgee was entitled to the thanks of the agricultural public for his valuable essay.

MR. BALDWIN said that Mr. Gamgee's paper proceeded on the assumption that pleuro-pneumonia was produced by contagion or infection, and never in any other way. It may be well to inform the meeting that many well-informed persons, who had given a great deal of attention to the subject, were not of that opinion. And he could not help thinking that it was worthy of a passing remark that there was in Edinburgh two veterinary colleges: the older presided over by Mr. Dick, the veterinary surgeon to the Queen in Scotland: the other, of more recent foundation, was the new veterinary college, of which Mr. Gamgee was the head. Now, the views of these two gentlemen were diametrically opposite on this intricate question. He did not wish to offer any observations on the respective abilities of the two distinguished principals of those rival schools of veterinary science; but the fact was as he had stated it. He (Mr. Baldwin) had, unfortunately, a good opportunity of studying this fearful malady. He did not presume to be professionally acquainted with the subject; he had studied and observed it as best he could outside the professional ring; and he was bound to state that he had seen many cases of the disease which, in his humble judgment, could not be traced to contagion or infection. He would trouble the meeting with a recital of the history of a case which had come under his observation a couple of weeks ago. A young animal reared on the Albert Model Farm, and which was grazed on a piece of grass remote from the farm offices, was, about two months ago, put up to fatten with a lot of others in a set of offices adjoining his residence. After they had been in about six weeks, he had heard a few of those coughs which arouse the suspicions of those who know the early symptoms of pleuro-pneumonia. He watched the case narrowly from that moment. It soon became but too evident that it was a decided case of pleuro-pneumonia. From prudential motives the animal was sold before the disease had advanced far; but he had followed her to the slaughter-house, and a clearer case of hepatized lung he never saw. He did not bring forward this case, or the result of his own observation, to controvert the views so eloquently put forward by Mr. Gamgee; he merely mentioned the facts for the purpose of fixing the attention of the meeting on the main question at issue. There are a few other points in Mr. Gamgee's paper which, if he (Mr. Baldwin) understood them correctly, he could not endorse. Surely, the rise in the price of meat could be explained away easily without any reference to the prevalence of disease. Again, Mr. Gamgee insinuates that this disease cannot be studied in any one district or country; but that you must travel, as he informs us he has travelled, over many lands. This appears a strange thing: to his mind the contrary doctrine was true. Mr. Gamgee's statistics of the prevalence of disease in Ireland were, in his opinion, exaggerated. It was impossible to reason with Mr. Gamgee on those statistics at present, as he did not submit to the meeting the data on which they were based. That disease was occasionally very prevalent in Ireland no well-informed person would deny; but he for one had reason to question the accuracy of Mr. Gamgee's averages, and would continue to do until he saw

theproof. A salesmaster who grazes about 3000 acres of land in the counties in which Mr. Gamgee's paper says pleuro-pneumonia is most prevalent, assured him (Mr. Baldwin), on the occasion of a visit he paid recently to one of that gentleman's farms, that the average loss from pleuro-pneumonia, in his large experience as salesmaster and grazier, did not exceed 5 per cent. on the difference between the purchase and selling price of his stock. Under these circumstances, he trusted the Royal Dublin Society would pause ere it endorsed the views of any gentleman, no matter what his talents may be, on a question of such vast magnitude.

Mr. Hugh Ferguson, Veterinary Surgeon to the Queen in Ireland, said—I regret not having been present to hear the earlier portions of Professor Gamgee's paper, which I consider an interesting one, particularly on account of his very elaborate and, as far as I have heard, I believe accurate geographical description of the march of, cattle pleuro-pneumonia throughout the European continent previously to its appearance in Great Britain. Shortly after its outbreak in Ireland I was under the impression that it was neither infectious nor contagious; but from reliable statistical information carefully collected and properly classified, I was shortly afterwards compelled to relinquish the opinion of its being neither infectious nor contagious, and come to the conclusion that it was both. I, however, from extensive experience, close observation, and a minute study of the malady and all the collateral circumstances connected with it, feel fully assured that cattle frequently become affected with pleuro-pneumonia from causes totally apart from those of infection or contagion. I have known the disease to break out under such well-marked circumstances of the animals being perfectly isolated from all other live stock, a distance of miles, sometimes even of sea, intervening between them and any other stock, that contagion and infection, as its source, were an impossibility. The disease often attacks cattle that have for even years been separated from all others. There is no doubt whatever but there are circumstances of season or atmospheric peculiarity which, when they are in operation, are productive of the disease. The malady being infectious and contagious is no reliable argument that it is never produced otherwise than as the effects of these causes; no more than it would be that it cannot be infectious or contagious because it is capable of being generated where the existence of infection and contagion previously is an impossibility. Mr. Gamgee states that a knowledge of the disease cannot be acquired in a single district or even country. My friend, the Caledonian Professor, must permit me to differ from him in opinion on this point, as well as on many others. However necessary travelling may be for the purpose of personal inquiries respecting the course by which the malady has travelled from the East through the European continent to Great Britain, a long residence in, and a personal acquaintance with, a locality, and the circumstances under which its stock is situated, are essential for the proper study of a disease, with respect to whether or not it can arise from any other causes but those of infection and contagion. Personal observation is the surest mode of coming to a proper conclusion, and on it and it alone are based the observations I make on the present occasion. My statements have facts which I have observed myself, and not merely heard from others, for their foundation. The epizootic pleuro-pneumonia, like typhus fever in the human being, is not alone capable of propagation by infection and contagion, but also of generation from other causes of a totally different nature. Typhus fever in the human subject is frequently found first to break out in a particular locality as a result of impure air, defective drainage, and too often, in Ireland, an insufficient quantity as well as deteriorated quality of food. But it is well known that once it has made its appearance, though from no infection or contagion, it is capable of being propagated further by both, not alone as regards an increase of the number of cases in the particular locality, but with respect to the extent of space having fever cases within it—the disease being frequently carried by infection and contagion from the original unhealthy locality in which it had been first incubated to some of the healthiest of the neighbouring, and sometimes even very remote districts. Under comparatively similar circumstances has pleuro-pneumonia frequently been observed to make its appearance in a locality without any cause connected with the previous existence of the disease elsewhere in that or the surrounding districts, and then, by infection and con-

tagion, be propagated even to a distant district to which some of the diseased cattle had gained access through the medium of agricultural commerce. With respect to an observation that has been made by the Lord Mayor Elect, that there is a deficiency of professional knowledge among the practitioners of veterinary surgery in Ireland, I think it will be found, although, to the disgrace of this country, they have been obliged to go to either London or Edinburgh for the purpose of getting their diplomas, there being no Irish veterinary college, that, as a result of their having availed themselves of the great facilities of medical and surgical study in Ireland, they are as well educated and as efficient as the veterinarians of England, Scotland, or any other country where veterinary surgery is recognised as a special vocation. I feel assured, were it feasible, which I doubt, that the simultaneous killing of every animal in the country affected with pleuro-pneumonia, no matter to how trifling a degree, and subsequently to that, the immediate destruction of every animal becoming attacked with the disease on its showing the first symptoms, would arrest the spread of the malady by infection and contagion, and in the long run be a pecuniary saving to breeders and graziers; but, as the disease frequently develops itself without being the result of either contagion or infection, no effectual means can possibly be taken to prevent its occasional recurrence from epizootical, or what is more commonly called epidemical, influences—influences of which, notwithstanding all the progress made in the sciences of investigation, we as yet know comparatively nothing excepting merely by their effects. The diseases of sheep at present form a particularly important feature for the consideration of the veterinarian, as well as of the agricultural community. They are much more prevalent and fatal this season than they have been for many previous years. This is attributable to the wetness of last spring and the preceding winter. Moisture is inimical to ovine vitality. A rather unusual disease has broken out among some of the flocks of Roscommon. The Secretary of the Royal Agricultural Society caused some of the diseased animals, as well as the viscera of others, to be sent to me for inspection. The disease which has proved so fatal is the presence of immense numbers of parasitical worms, about two inches long, and not thicker than coarse threads, in the windpipe, and its various ramifications throughout the lungs. To such an extent do those parasites accumulate in the air-passages, that they eventually cause death by absolutely suffocating the animal, preventing the inhaled air from purifying the blood by respiration, thus causing death. A similar affection is a very ordinary disease in the young of the oxen tribe, but it is comparatively rare in sheep. I have brought some of the parasites, as well as a portion of the lungs, with me to show to the meeting, and beg to present them for inspection. As Mr. Gamgee was present when I made the dissections, I feel pleasure in affording the gentleman an opportunity of making some observations on the subject.

MR. GAMGEE said, that in coming here it was his desire to give all the information he possibly could on this subject. He was prepared to demonstrate that in ninety-nine cases out of a hundred pleuro-pneumonia could be traced to infection or contagion. The strong opinions which he entertained were not the result of inquiries over a limited area, or into a few individual cases of disease. His inquiries extended over not only the entire of the United Kingdom, but also included the greater part of the continent of Europe; and he was fully justified in stating that there was scarcely a veterinarian of eminence, who had paid special attention to the progress of pleuro-pneumonia, who was not thoroughly satisfied as to the highly contagious character of the disease. He might refer to many instances in his own practice in Scotland, where attention to his directions as to preventive measures had been the means of saving entire herds, while neglect of the proper precautions had in other cases led to wholesale destruction. Again and again had an entire stock been lost by the purchase of a single beast from a dealer; and so well fortified was he in his opinions on the subject by the distribution of the disease throughou Scotland, that he had no difficulty at any time in pointing out the districts from which stock might be procured with the most perfect impunity. He could mention instances of the existence of small-pox in sheep in Wiltshire, and in other parts of England, where numbers of them were kept in fields far distant from the high roads, apparently removed from the danger of contagion; yet, when the matter was inquired into, it was found that those fields in which they were kept lay beside bye-roads, along which diseased sheep were driven for the purpose of evading the tolls on the high-roads. He showed that he

was right in his views by the facts that in England and Scotland the contagionists succeeded in their treatment of diseased cattle, while non-contagionists failed. The disease owed its existence in Australia to the importation of stock from Holland, and America suffered by importation from England. He was asked for a remedy for the evil. It would be premature to offer one; and it would be folly in him in a few minutes to attempt such a thing, which must be left for a future occasion. He should, however, express his thanks to Mr. Ganly for the manner in which he supported his (Mr. Gamgee's) views, and for his statements founded on a large experience. He felt that the few words Mr. Ganly had spoken that evening were of the greatest importance, for he wanted a confession from gentlemen of Mr. Ganly's class. Mr. Ganly was right in saying that it was impossible to prevent the evil, unless farmers were in some way compensated for their diseased stock; while there was a great deal of truth in what the Lord Mayor Elect said, that a premium should not be put upon diseased cattle. The farmers had now to sustain losses, and, of course, they should have still to sustain them, even in case of legislation for the prevention of disease. Scientific skill and judgment were required; and, instead of having a lot of veterinary surgeons drugging amd blistering, and so on, he wished for the application of science to prevent the disease by the inspection of stock, the separation of the sound from the unsound in the earliest stage, and the destruction of the latter. He would impress on them the importance of the subject, and the necessity for inquiry, which must be the prelude to the adoption of vigorous measures for combating the evil from which the country was now so severely suffering.

Lord Talbot de Malahide, as Chairman, tendered the thanks of the meeting to Professor Gamgee for the valuable information which he imparted to them that evening. His Lordship fully agreed with Professor Gamgee as to the importance of the subject, and the expediency of devising some remedy for the prevention of the disease of which he had so fully and ably treated. He thought that the adoption of a system of mutual insurance would be of great advantage in providing for the losses sustained by diseased cattle, and that strong measures should be taken for the destruction of the latter.

VI.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

The Lords of the Admiralty.

Airy (George Biddell, Esq., M. A., Astronomer Royal). Astronomical and Magnetical and Meteorological Observations, made at . . . . Greenwich, in the year 1860. 4to. *London*, 1862

El Observatorio de Marina de S. Fernando, *á la Sociedad Real de Dublin.*

Almanaque Náutico para el año 1863, Calculado de Orden de S. M. en el Observatorio de Marina de la Ciudad de S. Fernando. 8vo. *Cadiz*, 1861

The Rev. Beaver H. Blacker, A. M.

ΑΡΙΣΤΟΤΕΛΟΥΣ περι Κόσμου, προς Αλέξανδρον. . . . . 16mo. Glasguae, 1745

The Rev. Beaver H. Blacker, A. M.

Bamford (James). Ghent Guide, ... 12mo. *Ghent* 1843

The Rev. Beaver H. Blacker, A. M.

Catalogue of the . . . . . Library of John Dunn Gardner, Esq., of. Chatteris, Cambridgeshire . . . Bottisham Hall, Newmarket . . . 8vo. [*London*, 1854]

THE REV. BEAVER H. BLACKER, A. M.
Catalogue du Musée d'Anvers. 12mo. *Anvers, s. a.* [1855 ?]

THE REV. BEAVER BLACKER, A. M.
Catalogue Musée Royal de Peinture et de Sculpture de Belgique. 12mo. *Bruxelles,* 1851

THE REV. BEAVER H. BLACKER,, A. M.
Catalogue of the Library of Thomas Wallace, Q. C., Belfield. (MS bound with *Pneumatologia,* q. v.)

THE REV. BEAVER BLACKER, A. M.
Cries of Royal Blood, . . . Kings and Queens of England . . . murdered by their own Subjects . . . . Letters of Oliver *Cromwell, Hugh Peters,* and Sergeant *Bradshaw* . . . 8vo. *London,* 1722

THE AUTHOR, BY MR. S. B. OLDHAM.
De Nigris (J. B.; . . .) Important Discovery in the Solar System. . . . . 8vo. *London,* 1861

THE PUBLISHER.
Falconer's . . . . Railway . . . . and Steam . . . . Guide for Ireland. *Dublin,* 1862

THE REV. B. H. BLACKER, A. M.
Fontana (Johannis, Episcopi Cæsenatis). Opus Posthumum, Tyrocinium Episcoporum . . . . Clementi XI. inscriptum a Comite Aldigherio Fontana, ... defuncti Praesulis . . . Nepote. 8vo. *Venetiis,* 1717

THE AUTHOR.
Godkin (James, ...) A Handbook of the Education Question. Education in Ireland; . . . . 8vo. *London: Dublin,* 1862

THE LORDS OF THE ADMIRALTY.
Hansen's Lunar Tables, Errata in, . . . 8vo. [*London,* 1862]

THE AUTHOR.
Haughton (E., A. B., M. D., . . .) On the Theory of Vital Force: or the True Basis of Medical Science. . . . 18mo. *Dublin,* 1862

THE REV. BEAVER H. BLACKER, A. M.
Johnson (Samuel, LL. D.) Prayers and Meditations . . . . Published from his Manuscript by George *Strahan,* A. M. 12mo. *London,* 1813

CHRISTOPHER WALTON.
Law (William). Notes and Materials for an adequate Biography of. . . . . Elucidation of the Writings of Jacob *Böhme,* and . . . . . Dionysius Andreas *Freher;* . . .
Printed for Private Circulation. 8vo. *London,* 1854

THE REV. BEAVER H. BLACKER, ROKEBY, BLACKROCK.
Le Long (Jacobus . . . .) Bibliotheca Sacra seu Syllabus . . . . . Sacræ Scripturæ Editionum . . . Auxit Christianvs Fredericvs *Boernervs* . . . 8vo. *Lipsiæ,* 1709

——— Bibliothecæ Sacræ Pars altera . . . . ex nova recensione C. F. B. 8vo. *Lipsiæ,* 1709

THE AUTHOR, BY R. MALLET, ESQ.

Mallet (Dr. John William). Cotton: . . . conditions . . . in its Cultivation. . . . Cotton States of North America. 8vo. *London*, 1862

THE REV. BEAVER H. BLACKER.

Meagher (the Rev. Francis, ...) The Popish Mass, ... 8vo. *Cork*, 1823

THE GOVERNOR-GENERAL OF INDIA, IN COUNCIL, BY THOMAS OLDHAM, LL. D.

Memoirs of the Geological Survey of India. Vol. III., Pt. 1. . . . Published . . . . under the direction of Thomas *Oldham*, LL. D. 8vo. *Calcutta*, 1861

THE AUTHOR.

O'Hara (Henry, C. E.) The Cotton Plant, and the Countries adapted to its Culture. 8vo. *Manchestev*, 1852

O'Hara (Henrie, C. E., . . .) . . . the Classification and Arrangement of Public Museums, and other Collections, . . . 8vo. *Dublin*, 1862

THE REV. BEAVER H. BLACKER, A. M.

Ossian. Temora, ..., with other Poems. Translated from the Galic Language by James *Macpherson*. 12mo. *Dublin*, 1762

THE REV. B. H. BLACKER, A. M.

Oxford (Robert, Lord Bishop of). Sermon preached for promoting English Protestant Working Schools in Ireland, . . . April 2nd, 1747. 8vo. *London*, 1747

THE PUBLISHERS, MESSRS. MACMILLAN AND CO.

Oxford, Cambridge, and Dublin Messenger of Mathematics, ... Nos. 1, 2, 3. 8vo. *Cambridge*, 1862

BENNET WOODCROFT, ESQ., SUPERINTENDENT, ETC., GREAT SEAL PATENT OFFICE.

Patents of Canada, from 1824 to 1849. 8vo. *Toronto*, 1860

THE REV. BEAVER BLACKER, A. M.

Pneumatologia. MS. See Catalogue of Wallace's Library, MS. 1698

THE EDITOR, BERIAH BOTFIELD, ESQ., M. P.

Præfationes et Epistolæ Editionibus Principibus Auctorum Veterum præpositæ. Curante Beriah *Botfield*, A. M. 4to. *Cantabrigæ*, 1861

THOMAS OLDHAM, LL. D., ... SUPERINTENDENT.

Report (Annual) of the Geological Survey of India, and of the Museum of Geology. Fifth year, 1860–61. 8vo. *Calcutta*, 1861

THE REV. BEAVER H. BLACKER, A. M.

Riflessioni sopra la Pastorale di Monsignore Scipione de *Ricci* Vescovo di Pistoia e Prato, nella quale risponde alle accuse a lui date dal libro intitolato; Annotazioni Pacifiche di un *Paroco Cattolico* ec. . . . . 8vo. *Italia*, 1790

THE PUBLISHER.

Silent Politician. On the Future of Ireland, and its Capacity to exist as an independent State. 8vo. *Dublin*, 1862

CHRISTOPHER WALTON.

Theosophy. An Introduction to Theosophy, or the Science of the "Mystery of Christ." . . . ,
Vol. I. complete in itself. 12mo. *London, s. a.* [1854]

THE REV. B. H. BLACKER, A. M.

Thomas (John, D. D.) Sermon preached . . . for promoting English Protestant Working Schools in Ireland, . . . May 19, 1773. 8vo. *London*, 1773

THE ROYAL BAVARIAN ACADEMY OF SCIENCES AT MUNICH.

Transactions. Sitzungsberichte der Königl. bayer. Academie der Wissenschaften zu Munchen. 8vo.
Jargang 1860. *Munchen*, 1860
Jargang 1861, Band 1, and Band 2. Heft 1, 2. *Munchen*, 1861

THE AUTHOR.

Urwick (William, D.D.) Independency of Dublin of the Olden Time. . . . . 8vo. *Dublin*, 1862

THE REV. BEAVER BLACKER, A. M.

Waterloo. . . . . . Compiled from Captain Siborn's History of the War in France and Belgium. 16mo. *Brussels*, 1852

THE REV. B. H. BLACKER, A. M.

Wauters (Alp. Archivist of the City of Brussels). Brussels and its Environs . . . ., History . . . . Translated from the French. 16mo. *Brussels*, 1860

(Signed) EDW. RICHARDS PUREFOY COLLES,
Librarian.

BOTANIC GARDEN.

MR. M'NAB, *Royal Botanic Garden, Edinburgh*:—30 rare Plants, including several valuable Palms.

MISS WEBB, 2, *Winslow-terrace, Rathgar*:—2 parcels of Seeds from South Africa.

Ditto, ditto :—Parcel of Bulbs from South Africa.

Ditto, ditto :—23 packets of rare Australian Seeds.

Ditto, ditto :—Parcel of Cape Bulbs.

Miss Bunbury, *Picton, Bunbury, Western Australia*:—7 parcels of Seeds from Queensland.

Mr. David Drummond, M. R. D. S., *Dawson-street*:—25 kinds of rare species of Grass Seeds.

J. Beatty, Esq., 15, *Windsor-terrace, Kingstown*:—Parcel of East India Seeds.

W. Hamilton, Esq., *Observatory, Dunsink*:—Fine specimen of Myrtle Wood, for Museum.

Ditto, ditto :—Fine specimens of Wood of *Robinia pseudacacia*, for Museum.

C. Moore, Esq., *Director, &c., Government Botanic Garden, Sydney*:—Wardian case, filled with new and valuable Plants.

M. Otto, *Inspector, Botanic Garden, Hamburgh*:—17 rare Plants.

Mr. Leech:—Parcel of Seeds.

M. Bouché, *Inspector, Royal Botanic Gardens, Berlin*:—39 rare and valuable plants, including some Palms.

W. H. Baily, Esq., *Museum of Irish Industry*:— 3 packages of Seeds from New Zealand.

W. H. Baily, Esq,, *Geological Survey, Stephen's-green*:—3 papers of rare Seeds, from New Zealand.

Dr. Harvey, *Professor of Botany, Trinity College, &c.*:—7 packages of Seeds from Caffraria.

M. Cruger, *Director, Botanic Garden, Trinidad*:—Wardian case, filled with valuable Ferns and Palms.

M. Veitch, *Nurseryman, &c., Exotic Nursery, King's-road, Chelsea*:—4 very rare and valuable Plants, including 2 new species of Nepenthes.

The Commissioners of the New South Wales Department in International Exhibition, — Cowper, Esq , Secretary:—37 samples of Vegetable Produce, including Fruits, Fibre, Woods, &c., for Museum.

Mr. Sim, *Nurseryman, Foot's Cray, Kent*:—23 species of rare Ferns, &c.

Mr. Henderson, *Pineapple-place, London*:—8 species of rare Plants.

Mr. Williams, *Nurseryman, &c., Paradise Nursery, Holloway, London*:—23 kinds of rare Plants.

Lady Dorothea Neville, *Dangstein, Petersfield, Hampshire*:—8 very valuable Plants, including a Tree Fern (*Cyathea serra*), having a *clean stem* 12 *feet high*.

Mr. Marnock, *Royal Botanic Garden, Regent's Park, London*:—71 species of Herbaceous Plants, &c.

Dr. Thornton, per favour of Andrew Armstrong, Esq., M. R. D. S., 1, *D'Olier-street*:—Several fine Fruits of Star Apple.

MR. JOHN VEITCH, Jun., *Exotic Nursery, King's-road, Chelsea*:—Cones of some rare and newly introduced Plants from Japan, for Museum.

The EARL of LEITRIM:—Plant of Creeping Juniper, from the county of Donegal.

MR. CLARK, *Royal Botanic Garden, Glasgow*:—12 kinds of rare Plants.

MR. JACKSON, *Nurseryman, Kingston-on-Thames, Surrey*:—40 valuable Plants.

MR. LOWE, *Nurseryman, Upper Clapton, London*:—24 very valuable Plants.

THE CURATOR, *Royal Gardens, Kew*:—11 Plants, chiefly Palms.

W. WILSON SAUNDERS, Esq., *Reigate House, Reigate*, and *Lloyd's, London*:—Box of South African Bulbs and Tubers—68 in all.

DR. J. BURKE, 20th Regt. Foot, 12, *Lower Gardiner-street*:—Capsules and Seeds of the "Ochro" plant, *Hibiscus esculentus.*

MR. ANDERSON, *Nursery and Seedsman, Perth*:—20 species of rare Plants.

MISS CROZIER, 19, *Lower Dominick-street*:—38 kinds of Seeds, from Mauritius.

MISS WIERS, *Upper Gardiner-street*:—6 kinds of Seeds.

MRS. ROWLEY, *Kells*:—40 kinds of Seeds, from Australia.

MR. FRAZER, *Nurseryman, &c., Comley Bank, Edinburgh*:—30 species of rare and valuable Plants.

MR. STARK, *Nursery and Seedsman, Glen Nursery, Dean-bridge, Edinburgh*:—15 species of rare Plants.

A. DUNLOP, Esq., 95, *Baggot-street*:—Parcel of Seeds of Indigo Plant.

REV. E. CRAWFORD, *Drumcliffe Glebe, Co. Sligo*:—2 parcels of Australian Seeds.

M. WENDLAND, *Inspector, Botanic Garden, Herrenhausen, Hanover*:—16 species of very rare and valuable Plants.

ROBERT CALLWELL, Esq., 25, *Herbert-place*:—Seeds of Assam Tea Plant.

(Signed) D. MOORE, *Curator.*

NATURAL HISTORY MUSEUM.

CHARLES E. BAGOT, Esq., 4, *Upper Leeson-street*:—A few Insects from the neighbourhood of Adelaide, South Australia.

ALEXANDER BOXER, Esq., R. N.:—A small collection of Mammals, Birds, &c., from the N. W. coast of North America and the Islands of the Pacific Ocean.

J. O'NEILL, Esq., J. P., Mem. General Assembly, *Auckland, New Zealand*:—A few Marine Shells, from New Zealand.

SANDFORD PALMER, Esq., *Ballinlough, Roscrea, Co. Tipperary*:—A Horn of the Rocky Mountain Sheep, *Caprovis* (*Argali*) *Canadensis*; Horns of American Deer, *Cariacus Virginianus*; Horns of a Stag (*Cervus elaphus*), found near Roscrea; single Horn of a young Wapiti Deer, (*Cervus Canadensis*), first year's growth; and 2 young Green Plover (*Tringa vanellus*).

THOMAS BRAZILL, Esq., C. E., 12, *Holles-street*:—2 Whimbrels (*Numenias phæopus*), shot at Clonmacnois.

H. TWISS, Esq., M. D., *Ballinrobe, Co. Mayo*:—A Goat Sucker, female (*Caprimulgus Europæus*).

REV. JAMES GRAVES, *Chelsea Lodge, Duncannon, New Ross*:—A Shell (*Scalaria communis*), found on Duncannon strand.

GENERAL GREAVES, 7, *Hume-street*:—4 small cases of Minerals, and a box of Insects, from Elba.

S. R. GRAVES, Esq., *The Grange, Wavertree, Liverpool*:—The following specimens, dredged in the Baltic and the Cattegat, viz. *Idotea entomon*?, *Ophiolepis scolopendrina*, *O. texturata*, *O. squamosa*, *Asteropecten irregularis*, *Solaster endeca*, *Echinus miliaris*, (ditto, var. *Norvegicus*), *Echinocardium ovatum* (var. *Roseus*), *Brissus lyrifer*, *Aporrhais pes-pelicani*, *Pecten Danicus*, *P. opercularis*, &c.

JOHN RUSSELL, Esq., *Glenageary Hill, Kingstown*:—A Convolvulus H. Moth (*Deilephila convolvuli*), taken at Glenageary.

ROBERT WARREN, Esq., Jun., *Moyview, Ballina, Mayo*:—2 specimens of the Knot (*Tringa canutus*), and 1 of the Bartailed Godwit (*Scolopax ægocephala*).

MRS. DALEY, 10, *Richmond-hill, Rathmines*:—A Nest of the Weaver Bird.

JOHN G. RATHBORNE, Esq., *Dunsinea*:—A stuffed Wryneck (*Yunx torquilla*), England.

REV. PROFESSOR HAUGHTON, and ROBERT H. SCOTT, Esq.:—A collection of Minerals and Rocks, from the Co. Donegal.

ROBERT H. SCOTT, Esq., Lecturer on Mineralogy, R. D. Soc., and Hon. Sec. Geol. Soc.:—A series of Yellow Sandstone Fossils, from Mountcharles, Co. Donegal.

REV. PROFESSOR HAUGHTON, F. T. C. D.:—Minerals and Granites, from Sweden and Finland.

(Signed) ALEXANDER CARTE, *Director*.

Nov. 6, 1862.

INTELLIGENCE.

ANNUAL SPRING AGRICULTURAL EXHIBITION.

The Exhibition was held this year on Tuesday, April 22, and three following days. The weather, which was most unfavourable, seriously affected the attendance of the public. The Exhibition, although not so extensive as usual, sustained its previously high character by the excellence of the stock and implements exhibited. The challenge plate and cups were awarded as follows:—The Irish Farmer's Gazette Plate to Mr. Geo. Roe, D. L., for his short-horned bull, Leviathan; the Irish Railway Challenge Cup to the same gentleman, for the same animal; and the Ganly Challenge Cup to Mr. W. T. Crosbie, for his short-horned yearling bull, Crown of Athelstane.

The Meeting for the Announcement of Prizes was held in the Lecture Theatre on Wednesday evening:

His Excellency the Lord Lieutenant, President of the Society, in the Chair.

Mr. G. W. Maunsell, Secretary, said it became his duty to call upon his colleague Dr. Steele, the Assistant-Secretary to the Society, to read the prizes that day awarded to the successful competitors. Taking the present show as a reflex of the enterprise, industry, and prosperity of the country, they had no reason to fear that its future agricultural prospects would not be everything that its friends could wish. Extraordinary advantages had accrued to all sections of agriculture by the way in which the Society's shows had been fostered and carried out for many years. As the interest of Ireland in them had increased, the energies of the Royal Dublin Society had been taxed to no small extent to provide accommodation. For many years they had lived, it might be said, in temporary sheds; but they now were enabled to hold their shows in a noble hall, which during the last twelve months had been the scene of an exhibition of Fine Arts which did credit to the national industry and taste, and which had been visited by the Heir Apparent of these realms, and also by the late illustrious Prince who was Vice-Patron of the Society. That exhibition had scarcely closed when the increasing wants of the Society compelled them to extend their premises in a new direction; and they had hardly, by the removal of some houses and masonry, been enabled to give the exhibiters a foretaste of what they might hereafter expect, when the means of the Society, strengthened, as he trusted they would be, by private enterprise and by public aid, should be enabled to carry out the design so ably set on foot by Sir R. Griffith, by opening what might be called "Griffith's Court," which would double the extent of accommodation at the command of the Society—and not before it was needed—to the great advantage of the agricultural enterprise of Ireland. Turning from the cattle to the exhibition of implements in the lawn, it was cheering to see the enterprise there displayed, and to think how rapid had been the progress in that department. Every year had brought forth new items of farming implements, which did credit to those who sent them there without the attraction of prizes. It was not many years ago since this branch of farming industry was, he might say, wholly unknown. Year after year the enterprise of those engaged in the manufacture of farming machinery had been devoted to continued efforts to produce articles at once the most sufficient in their nature and the most simple in their detail; and those who looked at the lawn that day would see how ably those conditions had been fulfilled. Without attributing perfection to them, those implements reflected the highest credit on the skill and industry of those engaged in that department. Of late years, the value of artificial manure had, through the light of the science of chemistry, been more fully appreciated than before. On the table was a beautiful cup, the gift of a gentleman who was one of the earliest promoters of farming manures—Mr. Lawes. To him especially they owed the introduction of superphosphates in agricultural manures. The stock exhibited at the shows of the Society did not come solely from metropolitan districts, but was furnished by all the districts of the country. The midland and the southern contributed as well as the rest; the Kerry cow was giving way to the short-horn; and two of the highest prizes had been carried away by a Kerry gentleman

for stock of the short-horned breed, which half a century ago was probably unknown there. Mr. Bland was one of the successful competitors from the Queen's County; there were Mr. Richardson and Mr. Young from the north; and from the south he might also mention the Marquis of Waterford. One name he would not pass over in silence, for when they considered that the Judges—Englishmen, and unconnected with Ireland—had awarded the blue ribbon of the Society to the honoured name of George Roe, they had a right to be proud of the city of Dublin. Donnybrook had covered itself with glory,—Donnybrook had taken the palm from Meath and Westmeath; and while honoured names from those counties were to be found in particular classes, no less than two of the beautiful cups which were now displayed before them had been borne away by the Donnybrook farmer. Long life and honour to a gentleman who, having worthily illustrated a career of commerce in that city, stood forward now as one of the most honoured and worthy competitors in the race of agricultural industry.

Dr. Steele, Assistant-Secretary, then read the Prize List.

Lord Dunlo, one of the Secretaries, then moved a vote of thanks to the Judges who had officiated in the several departments at the present exhibition. He observed that the task which devolved on the Judges was one which became more difficult year after year, because of the more uniform excellence of the cattle and stock of all kinds. He had never known any exhibitions of this kind with the result of which every person was thoroughly well pleased; but it was generally found that the Judges who officiated at the exhibitions of the Royal Dublin Society gave as much satisfaction as the gentlemen who acted in a similar capacity in other places. From what he had heard on the present occasion, he did not think that this show was an exception to the general rule, and therefore they might conclude that the Judges had done their best, and pleased all parties. He believed that much of the value of these shows was due to those gentlemen, and he was sure that the meeting would cordially concur with him in thanking them for their valuable services.

Mr. R. C. Wade, in seconding the motion, said he had been a Steward at that and the Agricultural Society's shows for many years, and he never remembered one with respect to which he could say what he was happy to be able to state with reference to the present, namely, that not a single objection had been made to the decision of the Judges, on the ground of mistaken judgment. This was a strong proof of their perfect competence and of the admirable manner in which they had discharged their duties.

The vote of thanks to the Judges having been carried with acclamation,—

Mr. Charles G. Gray, of Ballykisteen, county of Tipperary, returned thanks for himself and his brother Judges. He observed that, as he was not one of the Judges of short-horns, he had not given special attention to that class; but he had seen enough to enable him to say that, if the show were not better than usual, it fairly represented the average of these exhibitions; and if he said that it had not receded in the quality of the stock exhibited, he thought that was as much as could fairly have been expected, considering the unfavourable seasons through which the country had passed. Some of the prizes had been awarded to exhibiters from Munster, and he was proud that the farmers of that part of the country with which he was connected had shown that they knew how to make their splendid pasture land available in the rearing of such superior cattle. The class of miscellaneous breeds, in which he was one of the Judges, appeared to him to be very poorly represented. Notwithstanding the prizes given by the Society for particular breeds, they did not seem to have been taken up in the country, and the prizes were carried away year after year by one nobleman or gentleman who happened to have that breed. It was for the Society to consider whether it was worth their while to continue giving medals for classes in which there was really no competition. The exhibition of implements was smaller than usual; but this was fully accounted for by the fact that the English manufacturers were busily engaged in preparing for the great show about to take place at Battersea Park, London.

The Earl of Clancarty, as senior Vice-President, said that it became his duty to convey to his Excellency the thanks of the Society for his attendance that evening, and for the interest which he had evinced in the success of their exhibition. The Society had

a great advantage in being presided over by one so capable of appreciating the value of their work, and who on all occasions so cordially associated himself in the efforts there made to develope the resources of the country, its industry, its artistic talent, and above all its agriculture, for the promotion of which latter object the Society was originally established and endowed by Parliament. Within the walls of that Society the works of Irish manufacturers had more than once been submitted to the discerning judgment of his Excellency; the students of art had frequently received the kindly encouragement of one who was peculiarly qualified to appreciate artistic taste; and on this, as on other occasions, his Excellency had not failed to afford the agricultural department of the Society the advantage and honour of his inspection. He was glad to find that specimens of peat fuel, which might prove so useful to the country, had found a place in the shows His Lordship went on to say that Ireland must be mainly dependent for its wealth and social improvement on the development of its agricultural resources, and expressed an opinion that the diminished cultivation of cereal crops in Ireland was not a matter of regret—that the poor were better off now than ever they were before, being better clothed, better housed, and better fed—that the destitute were all provided for—and that the condition of the country generally had undergone a great improvement. His Lordship concluded by moving a vote of thanks to the Lord Lieutenant.

Mr. J. W. Naper, D. L., of Loughcrew, seconded the motion. He felt bound to express the gratitude which he felt as an Irishman to an English nobleman and gentleman who had for so many years applied his mind and his talents to the advancement of the prosperity of this country. The attention which his Excellency had given to Irish affairs had caused men of his (Mr. Naper's) age and experience to have the greatest confidence in his opinion. In the course of some further observations, Mr. Naper said that it had taken twenty-five years to bring the breeding stock in Ireland to its present state of excellence; and he believed it would take twenty-five years more to bring the people of the country to a similar condition. This was a subject in which they all had the deepest interest, and it was their duty to do everything in their power to elevate the condition of the humbler classes. He trusted that some of them would live to see the people of Ireland enjoying those comforts in which they were now so deficient—occupying better houses, and living on more nutritious food.

His Excellency the Lord Lieutenant said,—My Lords and Gentlemen, if I may assume that the consent of this meeting to this motion which the noble Earl has moved will be given, I now beg to return my sincere thanks to this numerous and distinguished meeting for the honour which they have just been pleased to pay me; and I can assure you it is with even more than usual satisfaction that I find that I need not depart on this occasion from that uniform strain of compliment and congratulation which it has hitherto been my happy privilege to address to the members of the Royal Dublin Society at the period of their annual Easter meetings. For I will own to you that I was not without some degree of misgiving on this subject. I knew that the recent cycles of seasons through which we have passed have been of the most trying and unpropitious character. In the year 1859 there was a feature which has certainly since been very amply, too amply, atoned for—there was a prolonged absence of rain, which materially injured our pasture. In the years 1860, '61, I need hardly remind you, there was a great excess of rain, which did infinite damage to the country—which covered our plains with inundations, not yet wholly subsided—and which added a severe scarcity of fuel to the diminished production of food. Of course, these results could not take place without occasioning much partial distress. I naturally should not think of entering now upon any controversy as to the extent and amount of that distress. Most trying it is indeed to those who are intrusted with any discretion or responsibility at such periods to refrain from having resort to the most obvious and immediate methods of relief; and I believe there have been—and until very lately have been—conditions of Irish society in which there might have been an overpowering necessity for applying the most inartificial and blundering efforts of relief. The land was, to a great extent, divided between a sinking proprietary and a pauper peasantry. But now, except in very rare instances, it is in the district in which it is effected by the persons who are themselves interested—it is by spontaneous and independent effort that the struggle is made, and for the most part made successfully. Of course, we must still reckon upon encountering the occasional rigour of the seasons, just as in the sister countries probably still wider ravages are being now inflicted by the shocks of foreign

conflicts and the stoppage of raw materials. But I trust it will prove to be with the passions and the wrath of man as we know it will be with the strife and turbulence of the elements—since Nature is always found to restore her own excesses—and in sufficient periods to maintain her own averages. However, I entirely agree with the general bearing of the remarks which have been made by the Earl of Clancarty—that, whether we look to the geographical position of Ireland, or to the, character of her soil, there will be always such a prevalence of moisture and humidity as will make pasturage, and the production of animals, the most secure and remunerating form which our national industry can assume. I do not of course mean, as I am sure he did not mean, or no friend of Ireland could mean, to disparage tillage, or the proper production of corn crops in those districts which are by nature suited for them. Those districts abound in Ireland, and more especially is this the case with regard to oats. But still, coupling the physical condition of the country with the close proximity of those large English and Scotch markets, where there is such a vast consumption of meat, I believe that Providence has mainly appointed Ireland to be the mother of flocks and herds, and I consequently believe that she will fare all the better the more truly she keeps to her natural vocation. And in this useful and patriotic path no more salutary or efficient encouragement can be afforded her than is supplied by these annual spring exhibitions, coupled with those of the Royal Agricultural Society—these annual exhibitions which take place under the auspices of the Royal Dublin Society. These exhibitions, within the comparatively short limits of my own experience, have evinced a most remarkable progress. It is within these limits that you have housed your cattle, and we hear that in another year you are likely to roof your implements. I need not point out to you what an interesting and suggestive exhibition the implements collected in your yards to-day furnish to you, or over how wide an extent of usefulness they range. The facility of transport, for which we are indebted to our railway friends, has done an infinite deal in promoting every kind of agricultural competition; and we read now, too, of international exhibitions. The Emperor of the French has, with great sagacity, instituted them in his capital; and I am sure that we shall be glad to find that one of our most well-known exhibiters, who has obtained a prize in the competition of to-day, not content with the laurels he gathers in our show—I refer to Mr. Ball—has carried away the prize for heifers in the capital of France. I need not say how entirely I agree with the reference which Mr. Naper so aptly made even to the superior care and anxiety which we owe to the permanent welfare of those labourers who in fact really furnish the national wealth, which it should be the object of this exhibition to promote. We know that in the last twenty years, notwithstanding many of the drawbacks and vicissitudes to which I have referred, and of which we lately had experience, yet the stock of Ireland has increased in value within that period from £21,000,000 to £33,000,000. And with respect to quality, I think it is very probable that almost the worst animal in the yard to-day was as good a one as the prize animal of the same period back. I trust earnestly, my lords and gentlemen, that the varied excellences of these exhibitions, the numbers by which they are attended, the patronage by which they are honoured, the skill by which they are fostered, may all progressively advance. It is true that we cannot warm our skies with unclouded sunshine, we cannot mature failing crops, we cannot guard our sheep and cattle from all kinds of diseases; but we may continually furnish fresh aids to man in the struggle which he must always have to keep up with nature, giving the largest command over her bounties, and making difficulties themselves the spurs to his industry and the elements of his success.

The meeting then separated.

EVENING MEETINGS, ROYAL DUBLIN SOCIETY.

MONDAY, MAY 21, 1862.

Mr. GEORGE WOODS MAUNSELL, Secretary, in the Chair.

MR. MAHONY read a paper, entitled "Thoughts on the Social Position of Tradesmen." The communication, after referring to the many papers which have been written on the social condition of the artizan, stated that there were about 600,000 associated tradesmen in these kingdoms, whose weekly average earnings must be about

£725,000, or £8,770,000 a year. That vast sum was earned and spent annually amongst the rest of the community. This was only one of the many powerful facts which showed the importance of the working classes. Mr. Mahony complained that the working classes had yet no legislative enactment recognising and raising them in the social scale, which he contended could be done with advantage to the different trades, and benefit to the community at large, and without the slightest injury to the employer. They should secure the position of the working man, and secure him against the necessity for strikes. Mr. Mahony also submitted that the object of the legislature should be the security of the tradesman and his employer against alterations in trade usage, pay, &c. He also pointed out the many disadvantages under which he considered the working classes laboured in regard to their social advancement, and offered suggestions for the amelioration of their condition, in which the State, he thought, should participate.

A discussion arose on the paper, in which the Chairman, Mr. James Haughton, Dr. Barry, Mr. A. H. Bagot, and Mr. Peet took part.

Mr. William Glenny Crory read a communication "On the Development of the Industrial Resources of Ireland," in the course of which he observed that, even in the present condition of the land system or land question, Ireland presented greater attractions for an active population than could be had in any new country which could be selected for the purpose of emigration. Not only could all the necessaries of life be had in this country plentifully, and of the best quality, but the productive capabilities of the soil were capable of being increased three-fold by the wise and judicious outlay of capital and direction of labour. While at the present time people suffered from want of employment, he submitted that not only were there profitable fields of employment for all the population, but that there existed a want of all descriptions of labour, and that it would be a long time before the supply could exceed the demand, were the rich resources of the country adequately developed. The country offered great facilities for manufactures in its great water power and other essentials. Were the resources of Ireland duly attended to, a valuable home market would be created. The paper then alluded to the richness of the soil of this country, the mildness of the climate, the advantages of geographical position, the character and genius of the people; and concluded by stating that the time would come when Ireland would be full of commercial prosperity, and her people the most enterprising, because developing the richest resources in the world.

Several members expressed their respective opinions on the subject of the paper.

Mr. J. J. Greer exhibited and explained the construction and principle of Mr. Cooke's "New Patent Ventilator," which consists of two folds of copper-wire gauze, placed at right angles, and stretching across the top of a window. The lower fold admits the fresh, while the upper allows the vitiated, air to pass out through it, on the established principle, that while fresh air will force its way through the bottom, the vitiated air, being lighter, will ascend to the ceiling, and seek an egress through the nearest opening in the top of the window. Mr. Greer adduces numerous striking examples to prove this. Some time since, a Royal Commission was appointed for the purpose of inquiring into the sanitary condition of the people; and while the Commissioners unanimously ascribed the great increase of sickness to the absence of proper ventilation, they added that "the object in devising any mode for the effectual ventilation of dwellings is to be obtained by producing so gradual a movement of the air, that, whilst it constantly replaces the vitiated air, and keeps up a pure supply, its ingress shall be imperceptible to the occupants of the apartments." This is precisely what has been attained by this invention, as it admits an imperceptible and unceasing supply of pure air, constantly maintaining a cool and unvaried temperature, and never permitting the accumulation of heated or vitiated air. Mr. Greer quoted largely from the most reliable authorities to prove the truth of his theories.

Monday, November 17, 1862.

Mr. William Andrews, in the Chair.

Dr. Steele, Assistant-Secretary, read a paper by Henry Lawson, M. D., Professor of Physiology, Queen's College, Birmingham, on the Anatomy of *Limax maximus*. The paper is published in the present number.

Mr. Robert H. Scott, Lecturer in Mineralogy to the Society as *locum tenens* for Dr. Scouler, read a paper on "The Mineral Localities of Donegal, as ascertained by Sir Charles Giësecke and by the Committee of the British Association for the Advancement of Science." To be published in the next number.

Mr. Scott also read a communication on the subject of the new "Patent Peat Fuel," particularly as to its value as an agent for the reduction of iron ore. Samples of the patent fuel, and a pig of iron reduced by its means, were exhibited. The paper is published in the present number.

Saturday, December 13, 1862.

Lord Talbot de Malahide, Vice-President, in the Chair.

A highly interesting paper was read by Mr. John Gamgee, Principal of the new Veterinary College, Edinburgh, on the "Prevalence and Prevention of Diseases in the lower animals in Ireland." The paper, which was followed by an important discussion, is published in the present number.

Christmas Show of Fat Stock and of Farm and Dairy Produce.

This Annual Winter Exhibition for the present year was held on Tuesday and Wednesday, December 16 and 17. The Show Challenge Cup, presented by Messrs. Ferguson and Co., was won, the third and last time, by Mr. Allan Pollok, of Lismany, Ballinasloe, for a Polled Ox (No. 5), cross between a Galloway Cow and a Short-horned Bull, calved in 1859; and the Cup presented by Messrs. Dickson, Hogg, and Robertson, for the best collection of Green Crops, was awarded to the Earl of Charlemont.

School of Art.

The annual distribution of Prizes to the Students of the School of Art, and of the Schools in connexion therewith, took place in the Lecture Theatre, on Tuesday, December 23rd,

The Marquis of Kildare, Vice-President, in the Chair.

Edward Wright, LL. D., Chairman of the Committee of Fine Arts, addressed the Chairman as follows:—My Lord, on the part of the Fine Arts Committee, I have to thank your Lordship for your consenting to preside on the present occasion, and your kindly undertaking to distribute the prizes awarded by the Inspector appointed by the Committee of Council on Education at the examinations lately held here. In the course of these proceedings it will appear that as many as seventy-four prizes have been awarded to pupils of public schools of the metropolis and the suburbs. In explanation of this circumstance, it is proper to notice that the Government have ever been desirous of extending the benefit of art instruction to all classes in the community, and, as one means of advancing this object, make it a condition to their appointing pupil-teachers that each pupil-teacher should instruct at least 200 extern pupils. The Royal Dublin Society have always cordially co-operated with the Committee of Council on Education in this benevolent and practically useful object; and at the present time, having the prospect of about 300 additional extern pupils, are applying for an additional pupil-teacher. The progressive advancement in the proficiency of the pupils generally may be inferred from the number of the premiums now about to be distributed; and when it is remembered that the awarder of these prizes is a perfectly competent and independent Government Inspector, and that the examination is held in strict conformity with rules made by the Committee of Council on Education, it may be admitted that this inference is no unreasonable one, and that the successful candidates are well entitled to all the honors awarded to them,—this, at least, is the unanimous opinion of the Committee of Fine Arts. The Committee of Fine Arts also beg to notice that the Government Inspector, in his report, recognises an improvement in the tone of the classes, and remarks that the students who worked exercises in his presence had obtained a fair proportion of success. The Committee of Fine Arts, however, regret that the Inspector on this occasion conceived it was his

duty to set aside the works of an entire class of competitors, in whom the Society and a large portion of the public feel much sympathy—namely, the female pupils, who, on the solicitation of "The Society for Promoting the Employment of Women," were encouraged by the Society last year to commence the art of lithography, with the view of its being practically beneficial to them in their future struggle for life. It is, however, to be hoped that this inopportune discouragement will not permanently prejudice this humane cause. Talent, when united with industry, will surmount such difficulties, and, upon a future occasion, secure, as well as, perhaps, deserve, more attention and better success. My Lord, I now beg to place in your charge the largest number of prizes (viz., 149 awarded by the Government Inspector, two Royal Dublin Society's silver medals, and a certificate for anatomy, and two Taylor prizes) that has been distributed upon any similar occasion from this place to the students in arts, and which may be, under all the circumstances, the most satisfactory evidence that conld be adduced on behalf of the talent and industry of the pupils in connexion with the Royal Dublin Society.

The prizes were then distributed to the successful competitors.

The following is a list of the students who obtained prizes, viz.—

Names of Students who obtained Medals.—Mary M'Pettigrew, Roderick O'Farrell, Michael Stanley, Henry Bible, Harriette Brownlow, Isabella Lambert, Diana Sullivan, James Booth, Robert Walsh, Lizzie Langan, Jane M. Underwood, Marcella E. Prendiville, Lizzie Lambert, Georgina Williams, Thomas M'Neill, Marie O'Connor, Georgina Birch, Selina Bashford, and Hester Anna Harman.

Names of Students who obtained Honourable Mention.—Elizabeth Bredin, Frances Wilkinson, Jane Langan, Annie Thompson.

Names of those who obtained Prizes in Books, Drawing Materials, &c.—Anthony Baziere, Selina Bashford, James Booth, Douglas Samuel Boucher, Samuel P. Close, Henrietta Jane Coall, William Collins, Amanda E. Evans, Elizabeth Fulton, Lucy H. M. Hamilton, Henrietta Hamilton, Charles H. Hayes, Vincent Healy, Susan Johnson, Marianne C. Kenny, Louisa Lardner, Lizzie J. U. Langan, Marion Isabella Mallins, Mary Margaret Mooney, Thomas M'Neill, Roderick O'Farrell, Park H. Neville, Frederick F. Dwyer, John G. Kennedy, Edward Pigott, Mary M'Pettigrew, Marcella E. Prendiville, John Reilly, Emily S. Ryder, Michael Stanley, Matilda Stoker, Abraham Stoker, Diana Sullivan, Robert F. Walsh, and Frances Wilkinson.

External Pupils examined.—Central School, Marlborough-street, 55; Santry, 40; King's Hospital, 29; Hollyville Park School, 10; St. Catherine's School, 6; Ralph Macklin's School, 10; Tailor's Hall, 7; St. Andrew's School, 2; St. Bridget's School, 4; St. Peter's School, 1; St. Mark's School, 2; St. Michan's School, 3; St. Werburgh's School, 3.

The Taylor Prize of £30, for the composition painting, representing a scene from Dante's "Inferno," was awarded to Mr. Henry Crowley; and the second Taylor Prize, of £10, for the "Departure of the Hostages," was awarded to Mr. William Perry.

Thanks having been returned to the Marquis of Kildare for his kindness in presiding on the occasion, he responded, and said—I have had great pleasure on this occasion in being the means of giving away the prizes to-day. I regret that the President was not able to be here; but I have much pleasure in taking the chair in his absence. The total number of prizes awarded is 259, exceeding by 11 the number in any former year, which is a most gratifying circumstance. The number of pupils has increased also, which makes it difficult to make a calculation as to the relative numbers. Those who have received these prizes are all young persons, and we have great hopes that what has taken place here to-day will exercise an influence upon their lives. The Noble Marquis concluded by thanking them for the vote of thanks which had been passed to him.

The proceedings then terminated.

APPENDIX.

METEOROLOGICAL JOURNAL,

KEPT AT

The Royal Dublin Society's Botanic Garden, Glasnevin,

[HEIGHT ABOVE LEVEL OF SEA, 65 FEET],

FROM

1st JANUARY, 1862.

JANUARY, 1862.

DATE. Day, At 4 o'Clock, P.M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Wednesday, . . .	30·350	39	40	38	42	36	N.	0	Few, . .	Broken, . .	·020	Clear, like frost.
2 Thursday, . . .	30·350	39	39	37	40	28	W.	2	Many, . .	Do. . . .	. .	Dull and foggy.
3 Friday, ...	30·000	41	42	40	43	37	W.	3	Do. . .	Do. . . .	·030	Dull and changeable.
4 Saturday, ...	29·900	44	45	43	45	36	N. W.	3	Do. . .	Do. . . .	·020	Do.
5 Sunday, ...	29·880	45	46	44	46	35	W.	4	Do. . .	Do. . . .	. .	Do.
6 Monday, ...	30·050	41	42	40	42	36	S. W.	2	Do. . .	Do. . . .	. .	Do.
7 Tuesday, ...	29 720	50	51	49	51	38	S.	4	Do. . .	Do. . . .	·010	Gloomy, breezy day.
8 Wednesday, . . .	29·350	48	49	47	51	40	S. W.	6	Do. . .	Do. . . .	. .	Do.
9 Thursday, ...	29·380	50	50	48	51	41	W.	2	Do. . .	Do. . . .	·180	Fine breezy day.
10 Friday, ...	29·560	50	51	49	51	42	S. W.	3	Do. . .	Do. . . .	·070	Rain A.M., fair P.M.
11 Saturday, . . .	29·580	43	44	42	45	43	N. W.	0	Do. . .	Do. . . .	·170	Strong breeze, showery.
12 Sunday, ...	29·530	40	41	39	45	35	S. W.	5	Do. . .	Do. . . .	. .	Dull and hazy.
13 Monday, ...	29·450	43	44	41	48	36	S. E.	0	Do. . .	Do. . .	·200	Very wet day.
14 Tuesday, ...	29·790	37	37	35	46	32	W.	6	Few, . .	Do. . . .	·130	Clear like frost.
15 Wednesday, . . .	29·600	43	45	43	45	30	S. E.	1	Many, . .	Do. . . .	. .	Clear A.M., cloudy P.M.
16 Thursday, ...	29·750	47	47	45	48	41	S. W.	0	Do. . .	Do. . . .	·210	Rain A.M., fair P.M.
17 Friday, ...	29 850	45	45	43	47	37	N. W.	0	Do. . .	Do. . . .	·410	Dull and gloomy.
18 Saturday, ...	29·650	41	42	40	43	35	N. E.	1	Do. . .	Do. . . .	·030	Breezy, fine day.
19 Sunday, ...	29·500	40	41	39	42	39	S. E.	0	Do. . .	Do. . . .	. .	Dull and gloomy, drizzling rain.
20 Monday, ...	29·420	37	37	34	39	33	S W.	0	Do. . .	Do . . .	·050	Sleety showers, very col d.
21 Tuesday, ...	29·350	37	37	35	37	33	S. E.	0	Do. . .	Do. . . .	·010	Cold, gloomy day.
22 Wednesday, . . .	28·800	40	40	37	43	34	S. E.	2	Do. . .	Do. . . .	·300	Stormy, wet day.
23 Thursday, ...	29·170	43	43	40	44	33	E.	0	Do. . .	Do. . . .	·050	Do.
24 Friday, ...	28·930	43	44	41	45	41	S. W.	0	Do. . .	Do. . . .	·600	Do.
25 Saturday, ...	29·800	39	40	38	44	31	W.	4	None, . .	. . . . . .	. .	Frost A.M., fine P.M.
26 Sunday, ...	29·950	46	47	45	47	32	S. W.	4	Many, . .	Broken, . .	. .	Fine breezy day.
27 Monday, ...	29 700	46	47	45	47	46	S. E.	0	Do. . .	Do. . . .	. .	Fair A.M., showery P.M.
28 Tuesday, ...	29·480	48	49	47	50	45	S. W.	5	Few, . .	Do. . . .	·090	Fine breezy day.
29 Wednesday, . . .	29·480	49	50	48	50	44	W.	3	Many, . .	Do. . . .	·050	Stormy, cloudy day.
30 Thursday, ...	29·480	45	45	43	48	42	S. E.	0	Do. . .	Do. . . .	·110	Gloomy, wet day.
31 Friday, ...	29·600	53	53	51	58	43	S. W.	0	Do. . .	Do. . . .	·290	Stormy and wet.
								60	Total Amount of Rain,		3·030	Inches.

FEBRUARY, 1862.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Saturday, ...	29·810	51	52	50	53	50	S. W.	0	Many, . .	Broken, . .	·060	Dull, gloomy day.
2 Sunday, ...	29·830	51	53	51	58	52	S. W.	8	Do. . .	Do. . .	. .	Dull and mild.
3 Monday, ...	30·050	49	50	48	51	43	W.	6	Few, . .	Do. . . .	. .	Very fine day.
4 Tuesday, ...	30·080	56	57	55	57	48	S. W.	0	Many, . .	Do. . . .	·030	Dull, wet day.
5 Wednesday, . . .	30·000	49	50	48	58	48	W.	2	Do. . .	Do. . . .	·080	Showery A.M., fair P.M.
6 Thursday, ...	30·000	41	43	41	53	48	N. E.	5	Few, . .	Do. . . .	. .	Very fine day.
7 Friday, ...	30·250	39	41	39	45	33	N. E.	6	Do. . .	Do. . . .	. .	Do.
8 Saturday, ...	30·540	34	34	33	38	32	S. E.	7	None, . .	. . . .	. .	Fine, but very cold.
9 Sunday, ...	30·540	30	31	30	35	20	N.	6	Do. . .	. . . .	. .	Clear and frosty.
10 Monday, ...	30·424	40	42	40	43	20	N. W.	7	Few, . .	Broken, . .	. .	Frost A.M., changeable P.M.
11 Tuesday, ...	30·220	40	42	40	43	27	W.	8	Many, . .	Do. . . .	. .	Drizzling rain, chilly.
12 Wednesday, . . .	30·050	45	46	44	46	37	N. E.	0	Do. . .	Do. . . .	·030	Dull and hazy.
13 Thursday, ...	30·050	41	42	39	46	38	E.	0	Do. . .	Do. . . .	. .	Do.
14 Friday, ...	30·080	40	41	39	41	39	E.	0	Do. . .	Do . . .	. .	Do.
15 Saturday, ...	30·000	39	40	39	42	39	S. E.	0	Do. . .	Do. . . .	. .	Do.
16 Sunday, ...	29·650	41	41	40	48	37	E.	8	Do. . .	Do. . . .	. .	Strong breeze, and very cold.
17 Monday, ...	29·250	44	44	41	45	40	S. E.	0	Do. . .	Do. . . .	·020	Drizzling rain, cloudy.
18 Tuesday, ...	29·100	44	46	44	46	44	S. E.	8	Do. . .	Do. . . .	·030	Showery A.M., fair P.M.
19 Wednesday, . . .	29·150	42	43	42	45	40	E.	2	Do. . .	Do. . . .	. .	Dull and changeable.
20 Thursday, ...	29·200	40	41	39	43	40	S. E.	0	Do. . .	Do. . . .	·020	Do.
21 Friday, ...	29·400	49	50	47	50	37	S. E.	0	Do. . .	Do. . . .	·050	Do.
22 Saturday, ...	29·450	49	49	47	50	40	S. E.	7	Do. . .	Do. . . .	·260	Breezy, fine day.
23 Sunday, ...	30·078	50	51	50	54	35	S. E.	7	Do. . .	Do. . . .	·040	Fine, mild day.
24 Monday, ...	29·950	42	43	40	48	40	S. E.	2	Do. . .	Do. . . .	. .	Breezy, very cold.
25 Tuesday, ...	30·124	40	42	40	47	39	S. E.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
26 Wednesday, . . .	30·350	40	41	40	44	37	N. E.	2	Do. . .	Do. . . .	. .	Strong breeze, very cold.
27 Thursday, ...	30·200	37	38	36	38	36	N. E.	0	Do. . .	Do. . . .	. .	Do.
28 Friday, ...	30·000	40	42	40	42	37	N. E.	0	Do. . .	Do. . . .	. .	Do.
								71	Total Amount of Rain,		·570	inches.

MARCH, 1862.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Saturday,	29·880	38	39	37	39	37	N. E.	0	Many,	Broken,	. .	Dull and gloomy.
2 Sunday,	29·350	39	39	36	40	33	W.	8	None,	. . . . . .	. .	Very fine day.
3 Monday,	29·450	39	39	37	40	26	W.	7	Do.	Broken,	. .	Do.
4 Tuesday,	29·660	39	39	38	40	28	W.	8	Few,	Do.	·010	Fine, but very cold.
5 Wednesday,	29·100	50	50	47	50	29	N. W.	4	Many,	Do.	·180	Snow and thawing.
6 Thursday,	29·100	56	57	55	58	44	N. W.	5	Few,	Do.	·190	Rain A. M., fine P. M.
7 Friday,	29·200	50	52	50	55	45	W.	4	Many,	Do.	. .	Gloomy, mild day.
8 Saturday,	29·200	47	47	45	48	45	N. E.	3	Do.	Do.	·020	Do.
9 Sunday,	29·220	50	50	47	51	45	N. W.	8	Do.	Do.	·280	Do.
10 Monday,	29·350	51	52	50	53	40	N. W.	0	Do.	Do.	·020	Dull and mild.
11 Tuesday,	29·550	54	55	53	56	39	N. W.	4	Do.	Do.	·260	Showery day.
12 Wednesday,	29·570	44	45	43	46	39	N.	1	Do.	Do.	·180	Do.
13 Thursday,	30·280	47	48	46	48	40	N. E.	0	Do.	Do.	·060	Do.
14 Friday,	30·250	47	47	45	47	42	N. E.	6	Few,	Do.	. .	Fine, clear day.
15 Saturday,	30·160	45	45	44	47	40	N. E.	5	None,	. . . . . .	. .	Do.
16 Sunday,	29·900	46	47	45	47	39	S. E.	0	Many,	Broken,	. .	Dull and breezy.
17 Monday,	29·780	42	43	40	43	40	N. E.	0	Do.	Do.	. .	Dull and changeable.
18 Tuesday,	29·650	40	40	39	41	38	N. E.	0	Do.	Do.	·040	Showery, and very cold.
19 Wednesday,	29·550	43	44	42	44	38	N. E.	0	Do.	Do.	. .	Fair, rather cold.
20 Thursday,	29·570	41	42	40	44	40	N. E.	2	Do.	Do.	. .	Do.
21 Friday,	29·700	43	44	41	45	39	W.	1	Do.	Do.	. .	Do.
22 Saturday,	29·850	45	45	43	45	27	S. E.	8	None,	. . . . . .	. .	Fine, sunny day.
23 Sunday,	29·450	40	40	37	40	37	N. E.	0	Many,	Broken,	·250	Very wet day.
24 Monday,	29·390	40	42	40	44	38	N. E.	0	Do.	Do.	·520	Fair A.M., wet P.M.
25 Tuesday,	29·890	40	40	38	42	40	E.	0	Do.	Do.	·200	Showery day.
26 Wednesday,	29·830	44	45	42	45	40	N. E.	0	Do.	Do.	·360	Do.
27 Thursday,	29·240	48	50	48	50	39	S. E.	5	Do.	Do.	·080	Fine, mild day.
28 Friday,	29·680	49	50	47	50	45	S. E.	2	Do.	Do.	. .	Do.
29 Saturday,	29·180	50	50	48	51	40	S. E.	5	Do.	Do.	·060	Showery, cold day.
30 Sunday,	29·200	50	51	49	52	39	S. E.	5	Do.	Do	·060	Fine A.M., rain P.M.
31 Monday,	29·490	52	53	51	55	41	N. W.	6	Do.	Do.	·120	Do.
								92	Total Amount of Rain,		2·990	Inches.

APRIL, 1862.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Tuesday, ...	29·800	51	52	50	58	40	S. E.	4	Many, . .	Broken, . .	·020	Dull and mild.
2 Wednesday, . .	29·822	54	55	58	55	41	S. E.	7	Do. . .	Do. . . .	·070	Fine, sunny day.
3 Thursday, . . .	29·820	52	52	50	54	35	S. E.	2	Do. . .	Do. . . .	·400	Thunder, and heavy rain.
4 Friday, ...	30·000	44	45	48	45	32	S. E.	8	Do. . .	Do. . . .	. .	Breezy, rather cold.
5 Saturday, . . .	29·680	50	51	49	52	40	S. W.	2	Do. . .	Do. . . .	·100	Mild, showery day.
6 Sunday, ...	29·880	52	53	50	58	45	S. E.	2	Do. . .	Do. . . .	·100	Dull and showery.
7 Monday, ...	30·144	50	52	50	52	44	E.	7	Few, . .	Do. . . .	. .	Fine, sunny day.
8 Tuesday, ...	30·200	52	53	51	53	44	S. E.	9	Do. . .	Do. . . .	. .	Fine, breezy day.
9 Wednesday, . .	30·100	51	52	50	54	45	N. E.	6	None, . .	. . . .	. .	Fine, sunny day.
10 Thursday, . . .	30·120	47	48	46	50	39	N. E.	8	Few, . .	Broken, . .	. .	Breezy, fine day.
11 Friday, ...	30·300	39	40	38	42	32	N. E.	0	Many, . .	Do. . . .	. .	Cold and breezy.
12 Saturday, . . .	30·270	44	44	42	45	31	N.	9	Do. . .	Do. . . .	·050	Showery, and very cold.
13 Sunday, ...	30·200	43	44	42	44	29	N.	10	Do. . .	Do. . . .	. .	Fine, sunny day.
14 Monday, ...	29·800	48	49	46	49	36	N. W.	0	Do. . .	Do. . . .	·480	Very wet day.
15 Tuesday, ...	30·200	48	49	47	49	35	N. E.	6	Do. . .	Do. . . .	. .	Fine, mild day.
16 Wednesday, . .	29·690	52	52	50	54	38	S. W.	0	Do. . .	Do. . . .	·040	Fair A. M., rain P. M.
17 Thursday, . . .	29·630	53	54	51	55	39	S. W.	7	Do. . .	Do. . . .	·030	Mild and showery.
18 Friday, ...	29·610	55	55	53	57	40	S. W.	4	Do. . .	Do. . . .	·800	Heavy rain A.M.
19 Saturday, . . .	29·560	53	54	51	54	49	N. W.	7	Few, . .	Do. . . .	·270	Do.
20 Sunday, ...	29·800	57	58	56	59	34	N. W.	8	Many, . .	Do. . . .	. .	Fine, mild day.
21 Monday, ...	29·700	53	54	53	55	46	S.	8	Do. . .	Do. . . .	·010	Fine and breezy.
22 Tuesday, . . .	29·750	52	52	50	53	39	S. W.	4	Do. . .	Do. . . .	. .	Do.
23 Wednesday, . .	29·680	54	54	52	55	41	S. W.	6	Do. . .	Do. . . .	·020	Fine, mild day.
24 Thursday, . . .	29·600	51	52	49	54	42	S. W.	0	Do. . .	Do. . . .	·820	Very wet day.
25 Friday, ...	29·830	53	54	51	55	42	N. W.	0	Do. . .	Do. . . .	·430	Dull and showery.
26 Saturday, . . .	29·872	50	51	49	53	41	N. E.	0	Do. . .	Do . . .	·120	Do.
27 Sunday, ...	30·000	52	53	51	54	36	S. E.	2	Do. . .	Do. . . .	·030	Dull and cloudy.
28 Monday, ...	30·100	59	60	58	60	42	S E.	10	Do. . .	Do. . . .	·020	Fine sunny day.
29 Tuesday, . . .	30·100	61	61	59	61	37	S. E.	10	Do. . .	Do. . . .	. .	Do.
30 Wednesday, . .	30·070	59	60	57	62	49	S. E.	9	Do. . .	Do. . . .	. .	Do.
								130		Amount of Rain,	3·810	inches.

MAY, 1862.

DATE. Day. At 4 o'Clock, P. M.	BAROMETER. Height.	Temp.	THERMOMETER. Dry.	Wet.	Max.	Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Thursday, . . .	30·000	49	49	46	49	47	W.	0	Many, . .	Broken, . .	1·230	Very wet day.
2 Friday, ...	30·230	58	58	56	58	37	W.	10	Do. . .	Do. . . .	·280	Fine, sunny day.
3 Saturday, . . .	29·836	55	55	56	59	35	N. E.	8	Few, . .	Do. . . .	. .	Do.
4 Sunday, ...	29·580	54	55	52	55	44	S W.	2	Many, . .	Do. . . .	. .	Dull and changeable.
5 Monday, ...	29·840	58	59	57	59	46	S. E.	6	Few, . .	Do. . . .	. .	Fine, sunny day.
6 Tuesday, ...	29·650	57	57	55	58	41	N. W.	10	Do. . .	Do. . . .	·020	Fine, breezy day.
7 Wednesday, . .	29·680	57	58	56	58	42	N. E.	10	Many, . .	Do. . . .	. .	Do.
8 Thursday, . . .	29·500	54	54	51	54	45	N. W.	8	Do. . .	Do. . . .	·020	Strong breeze, and showery.
9 Friday, ...	29·400	54	55	53	55	47	W.	10	Do. . .	Do. . . .	·030	Mild, showery day.
10 Saturday, . . .	29·620	54	54	52	56	49	W.	4	Do. . .	Do. . . .	·080	Do.
11 Sunday, ...	29·580	53	54	52	54	42	W.	5	Do. . .	Do. . . .	·040	Dull and showery.
12 Monday, ...	29·690	55	56	54	56	56	N. W.	8	Do. . .	Do. . . .	·120	Showery day.
13 Tuesday, ...	29·700	57	58	56	59	42	N. E.	10	Few, . .	Do. . . .	. .	Fine, sunny day.
14 Wednesday, . .	29·800	60	60	58	61	45	S. W.	10	None, . .	. . . . . .	. .	Breezy, fine day.
15 Thursday, . . .	30·000	62	63	61	64	43	N. E.	10	Few . .	Broken, . .	. .	Sultry, warm day.
16 Friday, ...	30·050	60	60	59	64	46	S. W.	10	Do. . .	Do. . . .	. .	Do.
17 Saturday, . . .	30·080	67	67	65	67	47	S. E.	9	Do. . .	Do. . . .	. .	Breezy, fine day.
18 Sunday, ...	30·000	65	66	64	67	44	S. W.	10	Do. . .	Do. . . .	. .	Breezy and changeable.
19 Monday, ...	29·850	60	61	58	61	53	S. W.	8	Many, . .	Do. . . .	. .	Breezy, fine day.
20 Tuesday, ...	29·480	59	59	57	60	49	S.	8	Do. . .	Do. . . .	·180	Hail showers frequent.
21 Wednesday, . .	29·470	54	55	54	57	39	N. W.	6	Do. . .	Do. . . .	·090	Mild, and showery.
22 Thursday, . . .	29·600	55	55	53	59	40	N. W.	9	Do. . .	Do. . . .	·110	Breezy, fine day.
23 Friday, ...	29·680	57	59	57	59	57	W.	7	Do. . .	Do. . . .	. .	Do.
24 Saturday, . . .	29·830	55	56	54	61	57	S. W.	9	Do. . .	Do. . . .	·010	Showery day.
25 Sunday, ...	30·050	60	61	59	62	51	N. W.	10	Few, . .	Do. . . .	. .	Very fine day.
26 Monday, ...	29·910	60	61	59	62	50	W.	10	Many, . .	Do. . . .	·020	Mild, and showery.
27 Tuesday, . . .	29·700	64	66	64	66	53	S. W.	10	Few, . .	Do. . . .	·170	Breezy, fine day.
28 Wednesday, . .	29·710	54	55	52	55	49	S. E.	8	Many, . .	Do. . . .	. .	Breezy and changeable.
29 Thursday, . .	29·650	60	61	59	62	51	S.	7	Do. . .	Do. . . .	·010	Mild, and showery.
30 Friday, ...	29·800	59	59	57	60	41	S. W.	8	Do. . .	Do. . . .	·160	Rain A.M., fine P.M.
31 Saturday, . . .	30·000	60	61	59	61	47	E.	10	Do. . .	Do. . . .	. .	Very fine day.
								215	Total Amount of Rain.		2·420 inches	

JUNE, 1862.

DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	THERMOMETER. Temp.	Dry.	Wet.	Max.	Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Sunday,	30·050	64	64	62	65	49	S. E.	10	Few,	Broken,	. .	Very fine day.
2 Monday,	30·000	61	61	59	61	43	S.	6	Many,	Do.	·010	Dull and changeable.
3 Tuesday,	29·850	60	61	58	61	46	S. W.	5	Do.	Do.	·280	Heavy showers of hail.
4 Wednesday,	29·820	64	65	63	65	47	W.	10	Do.	Do.	. .	Fine, sunny day.
5 Thursday,	29·590	61	61	58	61	50	S.	7	Do.	Do.	·030	Showery day.
6 Friday,	29·150	58	57	55	58	50	S.	2	Do.	Do.	·280	Very wet day.
7 Saturday,	29·750	60	61	60	63	52	S. W.	8	Do.	Do.	. .	Very stormy day.
8 Sunday,	29·900	61	61	60	62	50	S. E.	9	Do.	Do.	·020	Showers A.M., fair P.M.
9 Monday,	29·900	57	58	57	59	43	N. W.	7	Do.	Do.	·060	Heavy rain P.M.
10 Tuesday,	29·640	55	55	53	56	42	E.	3	Do.	Do.	·040	Dull and changeable.
11 Wednesday,	29·050	54	54	53	55	49	N. E.	0	Do.	Do.	·580	Very wet day.
12 Thursday,	28·950	58	58	55	58	48	N. W.	3	Do.	Do.	·240	Do.
13 Friday,	29·300	56	57	53	60	51	S. W.	6	Do.	Do.	·090	Showery day.
14 Saturday,	29·550	64	64	62	65	47	W.	10	Do.	Do.	·150	Fine sunny day.
15 Sunday,	29·820	60	61	59	62	47	N. W.	9	Few,	Do.	·160	Do.
16 Monday,	29·950	60	61	58	60	48	S. W.	3	Many,	Do.	. .	Mild and changeable.
17 Tuesday,	29·800	61	62	60	62	49	W.	4	Do.	Do.	·170	Rain A. M., fair P. M.
18 Wednesday,	30·050	60	60	58	60	46	N. W.	7	Do.	Do.	. .	Fine mild day.
19 Thursday,	30·000	59	60	59	61	43	N. W.	4	Do.	Do.	·030	Breezy and showery.
20 Friday,	29·040	57	57	55	57	50	N. W.	2	Do.	Do.	. .	Cloudy and changeable.
21 Saturday,	29·850	60	61	59	61	47	N. W.	8	Do.	Do.	. .	Fine, breezy day.
22 Sunday,	29·700	60	60	59	60	49	N. W.	7	Do.	Do.	. .	Strong breeze, changeable.
23 Monday,	29·920	61	61	59	61	49	N. W.	10	Few,	Do.	. .	Fine, breezy day.
24 Tuesday,	30·030	66	67	65	67	54	N. W.	10	None,	. . . . . .	. .	Do.
25 Wednesday,	30·200	67	67	65	67	48	W.	10	Do.	. . . . . .	. .	Do.
26 Thursday,	30·020	60	61	59	61	54	N. W.	7	Many,	Broken,	. .	Breezy and changeable.
27 Friday,	29·850	59	60	57	60	48	N. W.	10	Few,	Do.	·030	Showery, mild day.
28 Saturday,	30·000	64	65	63	55	49	W.	10	Do.	Do.	. .	Fine sunny day,
29 Sunday,	29·850	58	61	58	61	54	S. W.	2	Few,	Do.	·070	Gloomy and showery.
30 Monday,	29·950	62	64	61	65	48	S. W.	10	Do.	Do.		Strong breeze, fine day.
								199	Total Amount of Rain,		2·240	inches.

JULY, 1862.

DATE. Day. At 4 o'Clock, P. M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Tuesday, ...	29·860	57	59	58	60	55	S. W.	2	Many, .	Broken, . .	·090	Stormy, wet day.
2 Wednesday, . . .	29·780	55	57	53	59	50	N. W.	6	Do. . .	Do. . . .	·300	Do.
3 Thursday, . . .	29·790	55	56	55	57	46	N W.	7	Do. . .	Do. . . .	. .	Dull and changeable.
4 Friday, ...	29 800	58	60	59	62	45	E.	10	Do. . .	Do. . . .	. .	Fine breezy day.
5 Saturday, . . .	29·250	53	53	53	55	50	E.	0	Do. . .	Do. . . .	·560	Very wet day.
6 Sunday, ...	29·200	57	58	57	60	52	N. W.	4	Do. . .	Do. . . .	·620	Heavy rain P.M.
7 Monday, ...	29·550	59	60	59	61	51	N. W.	8	Do. . .	Do. . . .	·060	Gloomy and changeable.
8 Tuesday, ...	29·950	61	64	62	64	49	S. W.	7	Do. . .	Do. . . .	. .	Breezy, fine day.
9 Wednesday, . . .	29 720	64	65	64	65	56	S. W.	2	Do. .	Do. . . .	. .	Do.
10 Thursday, . . .	29 650	64	64	63	64	45	S. W.	4	Do. . .	Do. . . .	·100	Showery day.
11 Friday, ...	29·740	55	57	55	57	47	S. E.	0	Do. . .	Do. . . .	·050	Do.
12 Saturday, . . .	29·750	55	56	53	57	50	S. W.	8	Do. . .	Do. . . .	. .	Fine mild day.
13 Sunday, ...	29·650	59	59	57	59	50	S. W.	6	Do. . .	Do. . . .	·060	Fair A. M., showery P. M.
14 Monday, ...	29·560	57	58	57	59	52	W.	4	Do. . .	Do. . . .	·500	Showery day.
15 Tuesday, ...	29·540	59	60	58	61	53	W.	6	Do. . .	Do. . . .	·180	Do.
16 Wednesday, . . .	29·700	61	65	63	65	52	S. W.	9	Do. . .	Do. . . .	·020	Fine breezy day.
17 Thursday, . . .	29·530	55	57	56	58	51	E.	2	Do. . .	Do. . . .	·290	Breezy, showery day.
18 Friday, ...	29·880	60	64	63	64	47	N. W.	10	Do. . .	Do. . . .	·050	Strong breeze, fair.
19 Saturday, . . .	29·840	61	61	57	62	51	S. W.	10	Do. . .	Do. . . .	·220	Breezy, fine day.
20 Sunday, ...	30·070	59	60	59	62	52	N. W.	8	Do. . .	Do. . . .	. .	Fine sunny day.
21 Monday, ...	30·060	57	58	57	59	49	N. W.	10	Few, . .	Do. . . .	·010	Do.
22 Tuesday, ...	30·080	59	62	61	63	50	E.	10	Do. . .	Do. . . .	. .	Sunshine A. M., cloudy P. M.
23 Wednesday, . . .	29·980	57	58	58	65	41	E.	10	Many, . .	Do. . . .	. .	Cloudy and sunshine.
24 Thursday, . . .	29·550	65	68	66	68	41	S. W.	7	Do. . .	Do. . . .	·230	Do.
25 Friday, ...	30 050	62	65	53	65	55	W.	10	Do. . .	Do. . . .	. .	Breezy, fine day.
26 Saturday, . . .	29·900	65	67	65	67	53	N. W.	10	Few, . .	Do. . . .	. .	Do.
27 Sunday, ...	29·930	60	63	61	64	54	W.	10	Do. . .	Do. . . .	. .	Fine mild day.
28 Monday, ...	30·100	59	63	60	65	51	S. W.	7	Many, . .	Do. . . .	. .	Do.
29 Tuesday, ...	30·000	57	60	59	64	51	N. W.	10	Do. . .	Do. . . .	·010	Breezy, fine day.
30 Wednesday, . . .	29·980	60	64	62	64	49	W.	8	Do. . .	Do. . . .	. .	Fine but changeable.
31 Thursday, . . .	29·800	62	65	62	65	50	N. W.	8	Do. . .	Do. . . .	·030	Do.
								208	Total Amount of Rain		3·380 inches	

AUGUST, 1862.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN	WEATHER, AND GENERAL REMARKS.
Day. At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Friday, ...	29·970	60	68	60	66	58	W.	10	Few, . .	Broken, . .	·070	Fine, mild day.
2 Saturday, . . .	30·000	61	64	60	67	54	W.	10	Many, . .	Do. . . .	. .	Fair A.M., changeable P.M.
3 Sunday, ...	29·800	64	67	65	68	55	W.	10	Do. . .	Do. . . .	·010	Fine, sunny day.
4 Monday, ...	29·550	57	59	57	60	50	S. E.	6	Do. . .	Do. . . .	. .	Stormy and changeable.
5 Tuesday, ...	29·270	55	57	56	57	47	W.	5	Do. . .	Do. . . .	·670	Very wet day.
6 Wednesday, . .	29·530	61	64	62	65	47	S. W.	7	Do. . .	Do. . . .	·010	Breezy and changeable.
7 Thursday, . . .	29·500	60	62	60	63	48	S. W.	6	Do. . .	Do. . . .	·200	Showery day.
8 Friday, ...	29·550	57	59	57	60	49	N. W.	5	Do. . .	Do. . . .	·190	Do.
9 Saturday, . . .	29·890	57	61	59	61	51	W.	6	Do. . .	Do. . . .	. .	Dull and gloomy.
10 Sunday, ...	29·950	55	57	55	59	50	W.	4	Do. . .	Do. . . .	. .	Fine, mild day.
11 Monday, ...	29·980	54	56	54	57	49	S. W.	8	Few, . .	Do. . . .	. .	Do.
12 Tuesday, ...	29·900	56	58	55	60	47	S. W.	6	Many, . .	Do. . . .	. .	Gloomy, mild day.
13 Wednesday, . .	29·680	56	59	56	62	48	S.	4	Do. . .	Do. . . .	·120	Gloomy A.M., rain P.M.
14 Thursday, . . .	29·800	63	65	63	65	52	S. W.	9	Do. . .	Do. . . .	·210	Rain A.M., fine P.M.
15 Friday, ...	29·840	64	66	64	66	54	N. W.	8	Do. . .	Do. . . .	. .	Fine, mild day.
16 Saturday, . . .	29·950	65	67	65	67	53	W.	8	Do. . .	Do. . . .	. .	Do.
17 Sunday, ...	29·950	60	68	62	68	50	N. W.	2	Do. . .	Do. . . .	. .	Dull and gloomy.
18 Monday, ...	29·900	65	67	65	67	47	W.	10	Few, . .	Do. . . .	. .	Fine, sunny day.
19 Tuesday, ...	29·750	63	65	62	65	45	S. W.	9	Many, . .	Do. . . .	·030	Dull and gloomy.
20 Wednesday, . .	29·950	63	64	63	66	50	E.	10	Few, . .	Do. . . .	. .	Fine, sunny day.
21 Thursday, . . .	29·850	63	63	62	64	45	S. E.	10	Do. . .	Do. . . .	. .	Do.
22 Friday, ...	29·920	59	60	59	62	47	W.	9	Many, . .	Do. . . .	·010	Light showers, fine day.
23 Saturday, . . .	30·130	60	64	62	65	45	W.	10	Few, . .	Do. . . .	. .	Fine, sunny day.
24 Sunday, ...	30·180	59	61	59	62	49	N. W.	8	Do. . .	Do. . . .	. .	Fine, mild day.
25 Monday, ...	30·150	60	62	60	62	47	W.	9	Do. . .	Do. . . .	. .	Do.
26 Tuesday, . . .	29·800	58	60	57	62	48	E.	2	Many, . .	Do. . . .	·280	Very wet day.
27 Wednesday, . .	29·990	65	67	65	68	49	W.	10	Do. . .	Do. . . .	. .	Warm and sultry.
28 Thursday, . . .	30·180	61	65	63	65	49	N. W.	7	Do. . .	Do. . . .	. .	Do.
29 Friday, ...	30·050	65	64	62	65	46	N. W.	10	Do. . .	Do. . . .	. .	Do.
30 Saturday, . . .	30·100	57	61	59	61	46	S. E.	7	Do. . .	Do. . . .	·040	Cloudy and overcast.
31 Sunday, ...	30·030	60	64	62	65	46	N. W.	6	Do. . .	Do. . . .	. .	Fine, mild day.
								280	Total Amount of Rain,		1·840	inches.

SEPTEMBER, 1862.

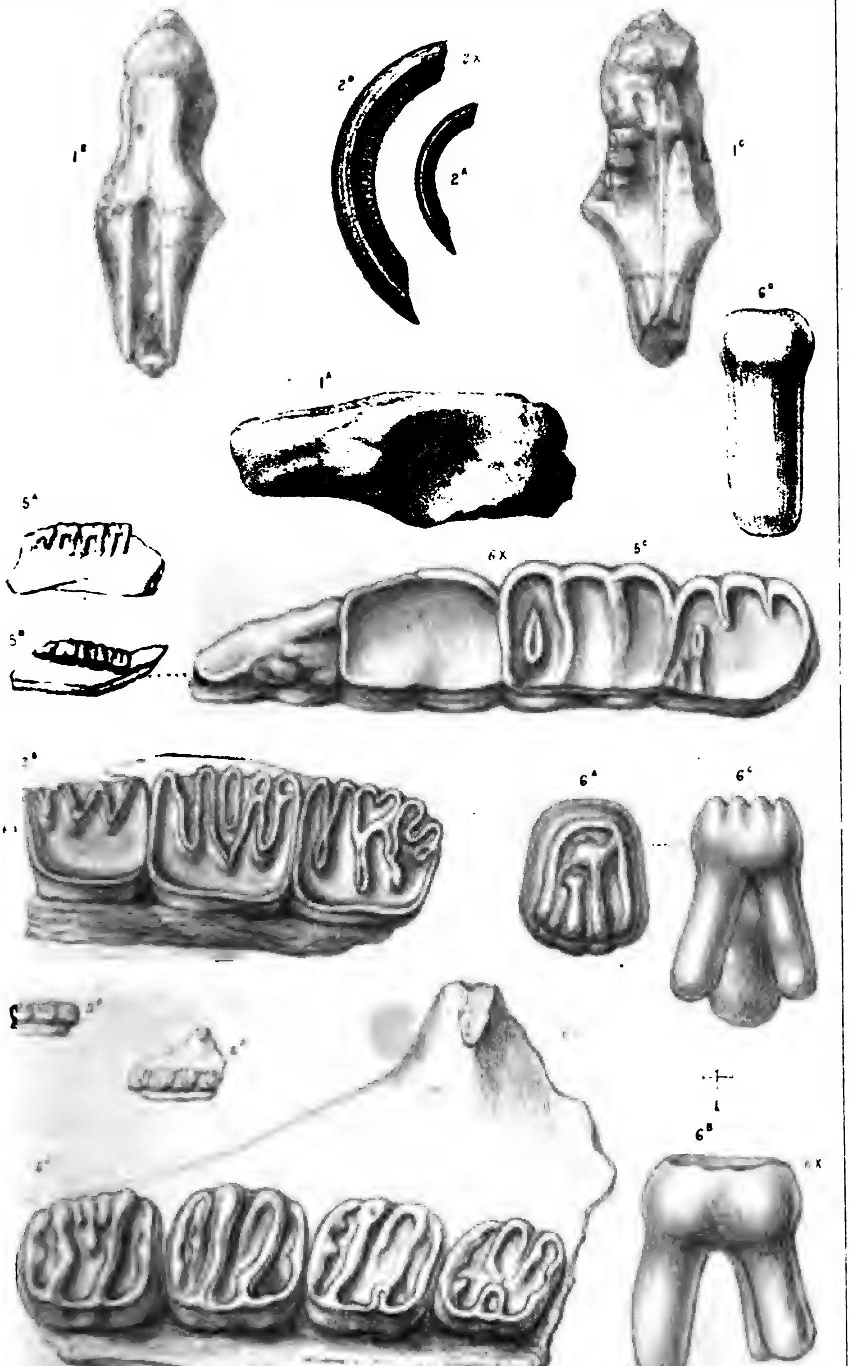
DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Monday,	29·950	58	63	61	63	47	N. W.	10	Few,	Broken,	. .	Fair A.M., rain P.M.
2 Tuesday,	29·570	55	57	54	57	43	W.	8	Many,	Do.	·190	Cloudy A.M., thunder and rain P.M.
3 Wednesday,	29·570	55	57	56	59	47	W.	0	Do.	Do.	·530	Cloudy and changeable.
4 Thursday,	29·800	57	58	56	58	49	N. W.	8	Do.	Do.	·110	Do.
5 Friday,	29·900	60	63	62	64	49	E.	7	Do.	Do.	. .	Do.
6 Saturday,	29·900	60	63	61	63	50	S. W.	0	Do.	Do.	. .	Fine, mild day.
7 Sunday,	29·950	62	64	62	64	49	S. W.	9	Do.	Do.	. .	Fine A.M., changeable P.M.?
8 Monday,	29·980	64	66	64	68	49	W.	4	Do.	Do.	. .	Drizzling rain A.M., fine P.M.
9 Tuesday,	29·980	55	60	58	60	49	W.	2	Do.	Do.	·010	Fine, sunshiny day.
10 Wednesday,	29·990	59	61	59	62	41	W.	10	Do.	Do.	. .	Dull and cloudy.
11 Thursday,	30·050	57	58	57	60	49	S. W.	0	Do.	Do.	. .	Fine, breezy day.
12 Friday,	29·990	64	67	65	67	50	S. W.	7	Do.	Do.	·020	Do.
13 Saturday,	29·640	53	53	52	53	52	W.	0	Do.	Do.	·260	Very wet day.
14 Sunday,	29·860	56	57	55	60	46	N.	10	Do.	Do.	. .	Fine, sunshiny day.
15 Monday,	30·130	55	58	57	59	40	N. E.	8	Do.	Do.	. .	Dull and cloudy.
16 Tuesday,	30·320	59	61	60	61	41	N. E.	10	Few,	Do.	. .	Fine, sunshiny day.
17 Wednesday,	30·330	60	64	62	64	41	N. E.	9	Do.	Do.	·010	Fine, mild day.
18 Thursday,	30·400	61	64	62	65	40	E.	10	None,	. . . .	. .	Fine, sunshiny day.
19 Friday,	30·350	61	63	62	64	43	E.	10	Do.	. . . .	. .	Do.
20 Saturday,	30·200	60	63	61	63	40	N. E.	10	Do.	. . . .	. .	Do.
21 Sunday,	30·170	60	64	62	64	42	N. E.	10	Many,	Broken,	. .	Do.
22 Monday,	30·030	61	63	61	64	44	E.	6	Do.	Do.	. .	Cloudy and overcast.
23 Tuesday,	29·950	57	59	56	62	46	E.	10	None,	Broken,	. .	Fine, sunshiny day.
24 Wednesday,	29·700	55	56	56	59	55	S. E.	0	Many,	Do.	·240	Very wet day.
25 Thursday,	29·730	60	61	59	65	54	N. E.	8	Do.	Do.	·150	Dull and showery.
26 Friday,	29 730	57	60	58	63	67	N. E.	4	Do.	Do	·620	Dull and gloomy.
27 Saturday,	29·820	61	63	62	64	48	S. E.	10	Do.	Do.	. .	Breezy, fine day.
28 Sunday,	29·770	59	60	58	62	52	S. E.	8	Do.	Do.	. .	Fine A.M., cloudy P.M.
29 Monday,	29·600	60	60	59	62	50	E.	6	Do.	Do.	. .	Dull and gloomy.
30 Tuesday,	29·650	57	59	57	61	43	N. W.	8	Do.	Do.	. .	Fine, mild day.
								198	Total Amount of Rain,		2·140	inches.

OCTOBER, 1862.

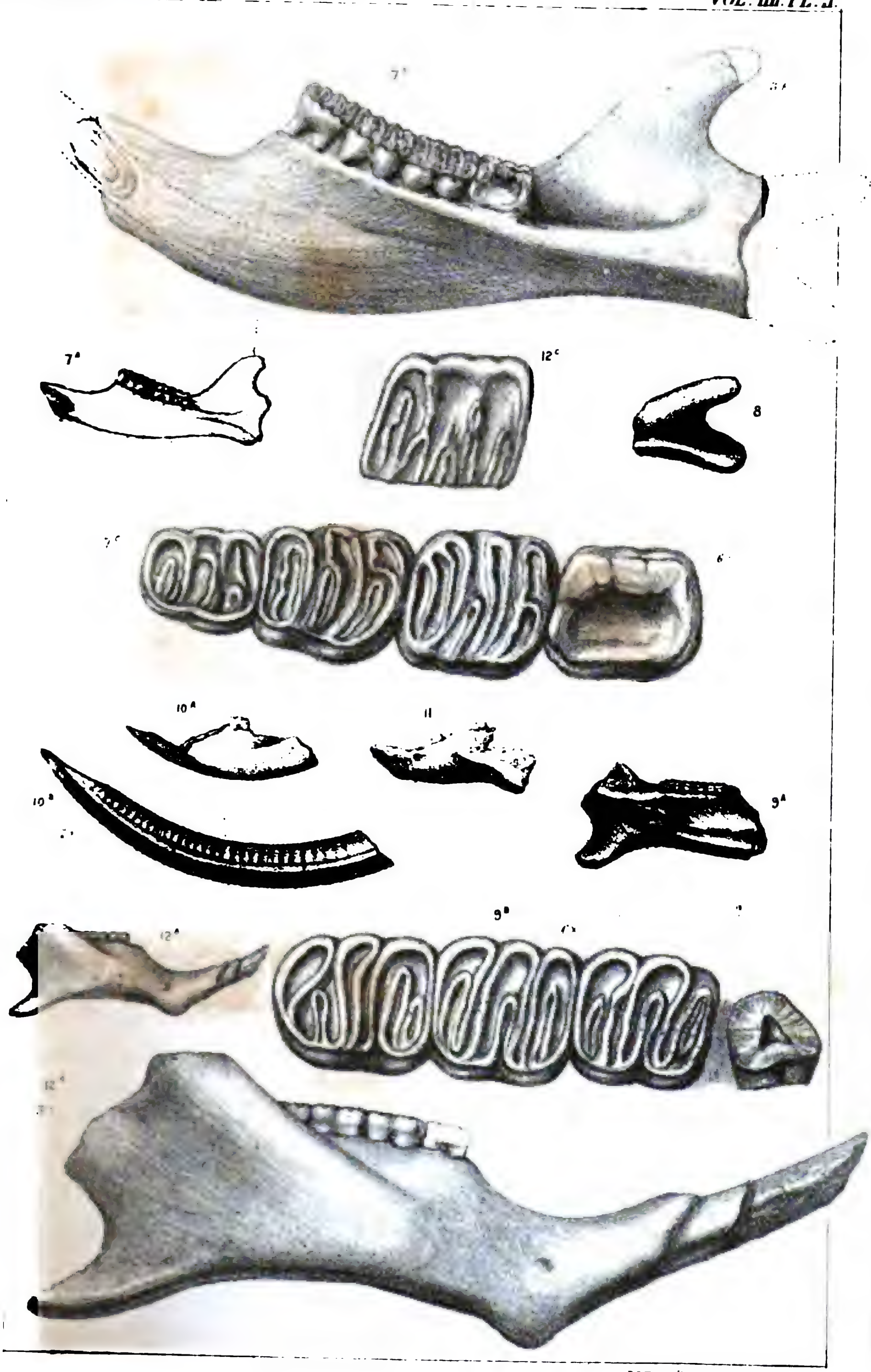
DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Wednesday, . . .	29·800	56	59	57	60	41	S. W.	2	Many, . .	Broken, . .	·070	Stormy and showery.
2 Thursday, ...	30·000	61	65	63	65	43	S W.	0	Do. . .	Do. . . .	·030	Dull and gloomy.
3 Friday, ...	30·180	64	65	65	66	60	S. W.	0	Do. . .	Do. . . .	. .	Do.
4 Saturday, ...	30·430	57	59	57	61	55	N. E.	4	Do. . .	Do. . . .	. .	Fair A.M., drizzling rain P.M.
5 Sunday, ...	30·150	57	59	57	60	48	N. E.	6	Do. . .	Do. . . .	. .	Gloomy and changeable.
6 Monday, . . .	29·828	55	55	54	55	50	E.	4	Do. . .	Do. . . .	·050	Showery day.
7 Tuesday, ...	30·200	55	57	56	57	37	N. E.	6	Do. . .	Do. . . .	. .	Fine, mild day.
8 Wednesday, . . .	30·350	57	58	57	59	48	N. W.	9	Few, . .	Do. . . .	. .	Do.
9 Thursday, ...	30·210	57	58	57	59	42	E.	10	None, . .	. . . . . .	. .	Fine, clear day.
10 Friday, ...	29·950	55	57	56	58	41	S. E.	0	Many, . .	Broken, . .	. .	Dull and changeable.
11 Saturday, ...	29·650	59	61	60	61	54	S. E.	8	Do. . .	Do. . . .	·130	Showery day.
12 Sunday, ...	29·350	50	52	50	63	51	S.	2	Do. . .	Do. . . .	·140	Do.
13 Monday, ...	29·540	51	53	52	53	45	S. W.	0	Do. . .	Do. . . .	. .	Dull and hazy.
14 Tuesday, ...	29·140	48	49	48	50	46	S.	2	Do. . .	Do. . . .	·050	Dull, wet day.
15 Wednesday, . . .	29·570	53	55	53	59	44	S.	10	Few, . .	Do. . . .	·010	Fine, clear day.
16 Thursday, ...	29·820	57	51	50	55	42	S. W.	8	Do. . .	Do. . . .	. .	Do.
17 Friday, ...	29·400	41	43	42	45	41	S. W.	2	Many, . .	Do. . . .	·530	Showery and stormy.
18 Saturday, ...	29·474	47	49	47	49	39	S. W.	9	None, . .	. . . . . .	. .	Fine, breezy day.
19 Sunday, ...	28·750	47	49	48	50	39	W.	0	Many, . .	Broken, . .	·040	Gloomy, wet day.
20 Monday, . . .	29·200	44	45	45	54	38	S. W.	5	Do. . .	Do. . . .	·100	Very stormy and showery.
21 Tuesday, ...	29·750	51	52	51	54	40	W.	2	Do. . .	Do. . . .	·030	Stormy and showery A.M., calm P.M.
22 Wednesday, . . .	29·350	45	47	45	54	45	W.	6	None, . .	. . . . . .	·040	Clear and stormy, very cold.
23 Thursday, ...	29·220	48	49	48	52	44	W.	3	Many, . .	Broken, . .	·240	Very stormy day.
24 Friday, ...	29·780	48	48	47	49	37	W.	6	Few, . .	Do. . . .	·050	Very fine day.
25 Saturday, ...	29·440	57	59	57	60	40	S. W.	4	Many, . .	Do. . . .	·020	Stormy and changeable.
26 Sunday, ...	29·600	50	52	50	55	44	N. W.	8	None, . .	. . . . . .	·800	Fine, breezy day.
27 Monday, ...	29·480	52	53	51	54	43	S. W.	2	Many, . .	Broken, . .	·030	Wet, stormy day.
28 Tuesday, ...	29·680	42	42	41	53	37	S. W.	8	None, . .	. . . . . .	·400	Fine, clear day.
29 Wednesday, . . .	29·800	46	49	48	49	34	W.	8	Do. . .	. . . . . .	. .	Do.
30 Thursday, ...	29·630	47	48	47	49	27	S. E.	7	Many, . .	Broken, . .	·030	Frost A. M., cloudy P. M.
31 Friday, ...	29·632	46	49	46	50	39	S. W.	4	Do. . .	Do. . . .	·420	Dull and changeable.
								140	Total Amount of Rain,		2·710	inches.

NOVEMBER, 1862.

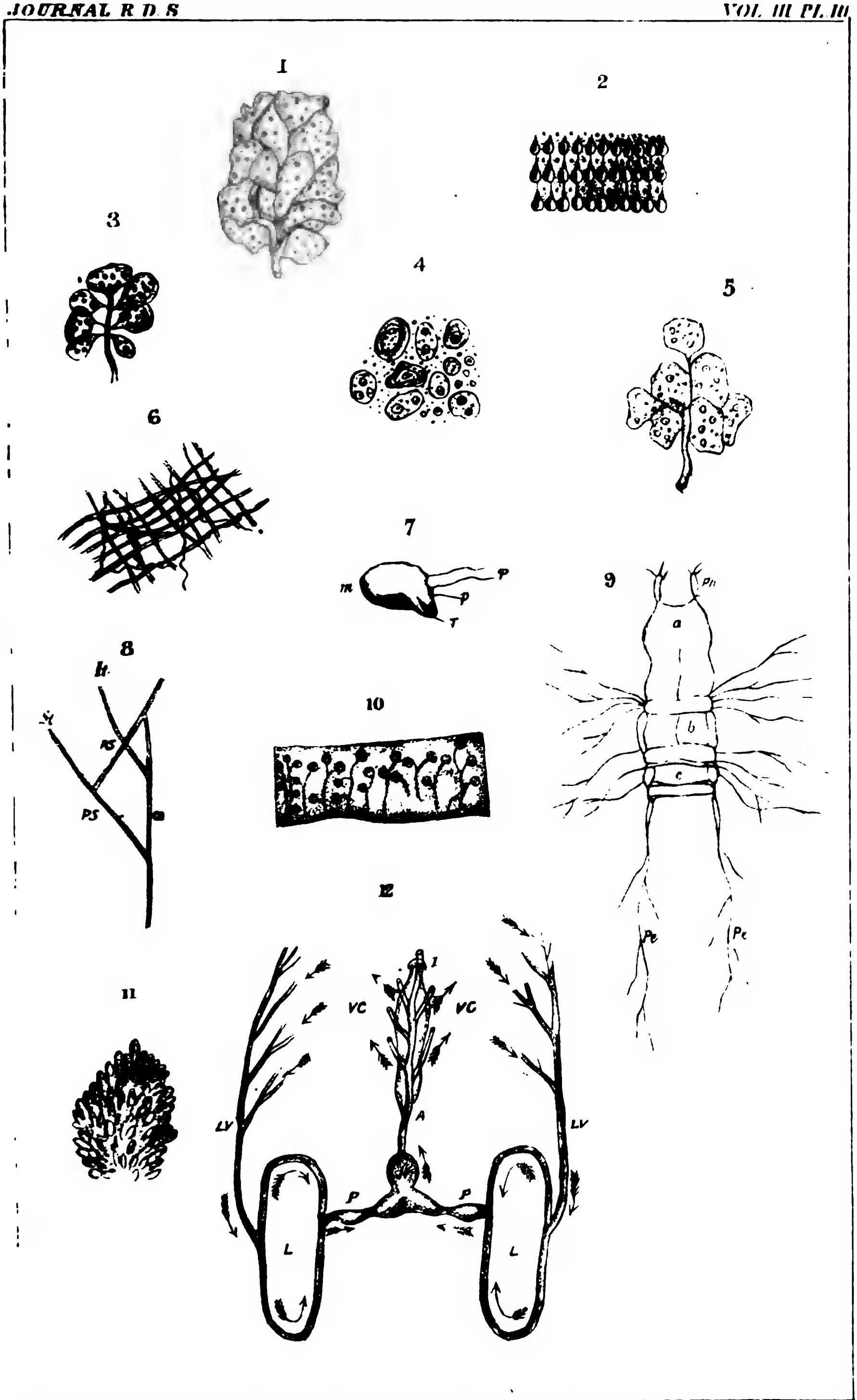
DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	Temp.	THERMOMETER. Dry.	Wet.	Max.	Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Saturday, ...	29·700	47	47	46	48	41	S. W.	6	Few, . .	Broken, . .	. .	Fine, clear day.
2 Sunday, ...	29·800	54	56	56	57	40	N. W.	5	Many, . .	Do. . . .	. .	Fair A.M., light rain P.M.
3 Monday, ...	29·750	55	55	54	56	44	S. E.	8	Do. . .	Do. . . .	·050	Dull and gloomy.
4 Tuesday, ...	29·960	45	46	46	48	39	S. W.	5	Do. . .	Do. . . .	. .	Do.
5 Wednesday, . . .	29·950	43	47	46	52	32	N. W.	6	Few, . .	Do. . . .	·080	Rain A. M., fine P. M.
6 Thursday, ...	29·016	43	45	44	47	31	N. W.	5	Many, . .	Do. . . .	·070	Frost A M, dull and cloudy P.M.
7 Friday, ...	30·280	47	49	48	50	30	N. W.	8	Few, . .	Do. . . .	. .	Fine, clear day.
8 Saturday, ...	29·900	47	49	48	49	37	S. W.	0	Many, . .	Do. . . .	·020	Stormy day.
9 Sunday, ...	29·440	43	44	43	44	40	S. W.	6	Few, . .	Do. . . .	·240	Fine, breezy day.
10 Monday, ...	29·120	34	36	35	39	32	S. W.	4	Many, . .	Do. . . .	·180	Snow showers, and very stormy.
11 Tuesday, ...	29·590	37	38	36	40	30	S. W.	6	None, . .	. . . . . .	. .	Very cold, fine day.
12 Wednesday, . . .	30·050	39	39	39	41	30	W.	6	Do. . .	. . . . . .	. .	Fine, clear, like frost.
13 Thursday, ...	29·750	42	43	42	44	26	S. W.	0	Many, . .	Broken, . .	·230	Very wet day.
14 Friday, ...	30·000	44	45	44	45	31	N. W.	8	None, . .	. . . . . .	·040	Fine, clear day.
15 Saturday, ...	30·228	42	44	43	45	29	N. W.	8	Do. . .	. . . . . .	. .	Do.
16 Sunday, ...	30·250	46	48	46	49	33	N. W.	7	Do. . .	. . . . . .	. .	Do.
17 Monday, ...	30·374	41	42	42	48	27	N. W.	8	Do. . .	. . . . . .	. .	Do.
18 Tuesday, ...	30·270	37	38	37	40	25	W.	7	Many, . .	Broken, . .	. .	Clear A.M., foggy P.M.
19 Wednesday, . . .	30·230	40	43	42	43	27	N.	6	Do. . .	Do. . . .	·020	Fine, mild day.
20 Thursday, ...	30·180	40	41	40	42	40	E.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
21 Friday, ...	30·168	41	43	42	43	37	N. E.	0	Do. . .	Do. . . .	. .	Do.
22 Saturday, ...	29·800	38	41	40	41	32	N. E.	2	Do. . .	Do. . . .	. .	Do.
23 Sunday, ...	29·600	38	39	38	40	32	S. E.	5	Do. . .	Do. . . .	·030	Fine, mild day.
24 Monday, ...	29·780	37	38	37	39	28	S. E.	8	None, . .	. . . . . .	. .	Fine, clear day.
25 Tuesday, ...	29·780	35	37	35	39	20	S. E.	8	Do. . .	. . . . . .	. .	Do.
26 Wednesday, . . .	29·400	37	39	37	39	25	S. E.	8	Many, . .	Broken, . .	. .	Dull and gloomy.
27 Thursday, ...	29·350	38	40	39	42	37	S. W.	9	None, . .	. . . . . .	·010	Fine, clear day.
28 Friday, ...	29·430	43	45	44	45	30	S. E.	0	Many, . .	Broken, . .	·310	Gloomy, wet day.
29 Saturday, ...	29·560	42	43	42	45	32	S. E.	5	Few, . .	Do. . . .	·150	Fine, breezy day.
30 Sunday, ...	29·946	43	45	44	45	29	S. E.	6	Many, . .	Do. . . .	·010	Dull and changeable.
								150	Total Amount of Rain,		1·440	Inches.



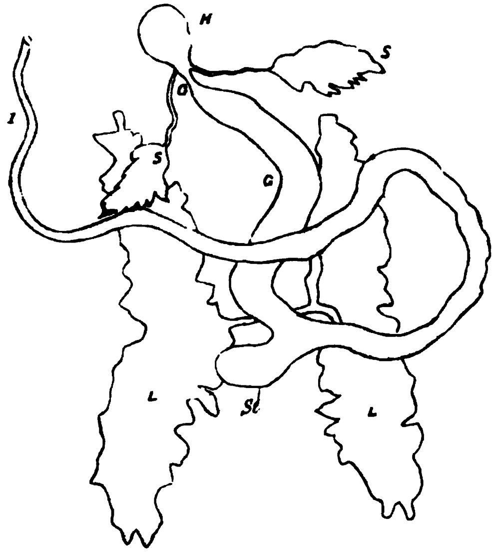
W. H. Baily del et lith.



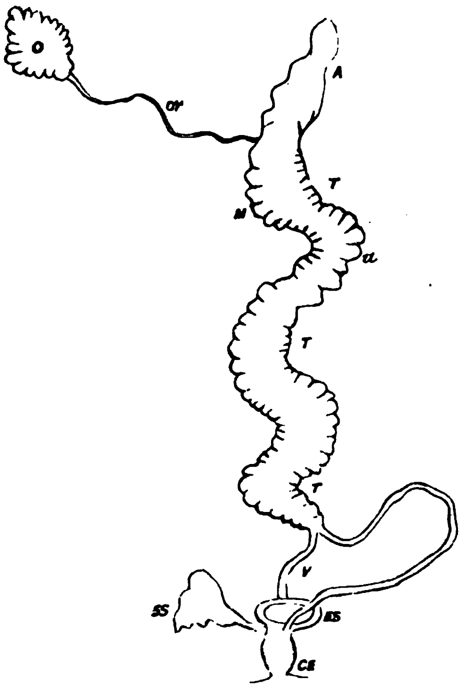
W.H Baily del. et lith.


1
2
3
4
5
6
7
m
p
p
r
8
9
a
b
c
Pe
Pe
10
11
12
VC
VC
A
LV
LV
P
P
L
L

1



2



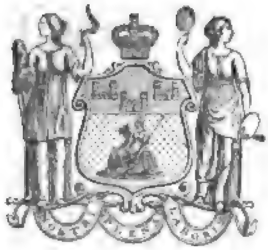
No. XXIX.] APRIL. [Price 1s. 6d.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

Published Quarterly.



CONTENTS:

		PAGE.
1.	Mr. Andrews' Notes on the Salmon Fisheries of Ireland,	81
2.	Mr. Reeves on the Irish Salmon Fisheries,	101
3.	Mr. Scott on the Mineral Localities of Donegal,	114
4.	Mr. Reynolds on Wood Spirit and its Detection,	126
5.	Mr. Reynolds on pure Methylic Alcohol,	131
6.	Return of Donations to the Royal Dublin Society,	132
7.	Intelligence,	139
	Appendix—Meteorological Journal for the Month of December, 1862,	xiii
	Summary of Meteorological Tables for the year 1862,	xiv
	Meteorological Journal for the Month of January, 1863,	ii

DUBLIN:
HODGES, SMITH, AND CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.
1863.

M. H. Gill, Printer to the Royal Dublin Society.

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

THE Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Registrar:—

Life Membership, ...	£21	0	0
Annual Membership (with £3 3s. Entrance Fee),	2	2	0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15s.

I.—MEETINGS OF THE SOCIETY.

1. *Stated and Ordinary Meetings.*

The Society meets at 2 o'Clock P. M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday in November.

2. *Evening Scientific Meetings.*

Meetings of the Society and of the Associated Societies, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session. The business is conducted in the following sections:—

I. AGRICULTURE and Rural Economy, and Horticulture.

II. FINE ARTS.

III. NATURAL SCIENCES, including Zoology, Botany, Physiology, Mineralogy, Geology, Physical and Descriptive Geography.

IV. EXPERIMENTAL SCIENCES, including Physics, Chemistry, Physiology, Meteorology, and the Mechanical Arts.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society, and in the Quarterly Journal of Science.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5s. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6*d*. each; or to twelve for 5*s*., available for any of the ordinary Meetings throughout the Session.

THE COUNCIL AND COMMITTEES.

The Council, which comes into office in January, meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

Eight Standing Committees are annually elected, as follows:—1. Agriculture; 2. Botany; 3. Chemistry; 4. Fine Arts; 5. Library; 6. Manufactures; 7. Natural History; 8. Natural Philosophy. Besides these are the Evening Meetings Committee and Sectional and occasional Committees.

II.—DEPARTMENTS OF THE SOCIETY.

1. *Agriculture.*

a. THE ANNUAL SPRING SHOW of Cattle, Poultry, and Implements, is held on Tuesday in Easter Week.

b. THE CHRISTMAS SHOW of Fat Stock and Farm and Dairy Produce is held in the Third Week of December.

c. CHEMICAL ANALYSES of Agricultural Produce, Soils, Manures, &c., are performed in the Laboratory, under the superintendence of the Professor of Agriculture, according to a fixed scale of moderate charges.

d. THE AGRICULTURAL MUSEUM open daily (Sundays excepted) from 11 to o'Clock.

[*For continuation, see page* 3 *of Cover*.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

APRIL, 1863.

VII.—*Notes on the Salmon Fisheries of Ireland.* By WILLIAM ANDREWS, M. R. I. A., &c., President of the Natural History Society of Dublin, Vice-President of the Royal Zoological Society of Ireland.

[Read January 22, 1863.]

THERE are but few departments of the industrial resources of a country fraught with more interest or more importance than its fisheries. From the earliest days their protection and encouragement were viewed as the surest means of promoting and of securing the mercantile position and the naval power of a maritime nation. Thus, whenever legislation directed attention to such, industry and prosperity marked their progress, while, on the other hand, neglect equally caused their decline. If we were to scan the histories of past reigns, we should find how seriously the subject of the fisheries have agitated our rulers; and if we bring such reviews down to the present time, it may be justly asked, in what manner those principles of our forefathers have been maintained.

These remarks embrace the fisheries generally, but the objects of my present paper will be wholly confined to those that are termed our "Inland Fisheries."

The salmon fisheries of Ireland may be said to be more valuable in their bearings, and more available in their produce, than those that exist in any similar extent of country of the United Kingdom.

Circumstanced as they are, comprising such extensive public privileges, far predominating over private rights, and yet so conflicting with numerous interests, ever combating to be established, that the most stringent enforcements are necessary for the due observance of such laws as may place all parties within the bounds of their legitimate claims. Hence

it is imperative that not only those fisheries, but our sea fisheries, should be under the necessary control, and be governed by proper legislation, through a public department invested with suitable powers. But there has been the difficulty—Commissions have been instituted, and committees have repeatedly sat to investigate and to establish some sound basis, yet their efforts have hitherto been unavailing, and bills have almost annually been presented to Parliament, " to consolidate and amend those laws, and to assimilate them to those of England."

The true habits of the salmon, in its distribution, have caused much perplexity; and nowhere do difficulties more beset the subject, than where practical knowledge cannot combine scientific inquiry, or where scientific knowledge is destitute of practical investigation.

To the year 1842, the "*Irish Fisheries*" were under the domination of twenty-six Acts of Parliament, many differing in their determination of essential points, and such confusion constantly arose from their inoperative effects, that an almost total neglect of all law was the consequence. The Act of 5th and 6th Victoria established a sounder basis. Its sections repealed the Act with reference to 10th of Charles I.—*by implication* repealed the clauses of Magna Charta, with reference to the fisheries, and repealed all the English Acts, anterior to the 10th of Henry VII., Poyning's law, which extended to Ireland all the English Acts. Four subsequent Acts to 5th and 6th Victoria were given as amendments and additions, which formed a code that, with but slight alterations, would be fully sufficient for all purposes of administrative laws for the fisheries of this country. Still, agitation was the order, and ponderous bills were constantly prepared and brought in. Mr. Anstey, in 1850, proposed to sweep away vested rights—enforce Queen's gaps in all weirs, *but allowing compensation*. Mr. Connolly's bill, in 1852, imposed the same measure. Mr. Cardwell's, of 1861, had similar objects; but Mr. M'Mahon's, of the past year, dealt sweepingly with all rights, and denied any compensation. This singular bill had, however, some good points; but so determined was the desire to hurry its completion, and so determined the opposition to it, that, though originally consisting of 157 clauses, it dwindled and crumbled away, until at last only a few clauses remained for the final consideration of the committee.

In years past, when fishery laws had little efficacy, the rivers of Wexford and of Carlow, the Slaney, the Barrow, and the Burren, were familiar to me as an indefatigable angler and fly-fisher. The lakes and rivers of the western parts of Clare and of Kerry were equally well known and explored. The interest that then marked such pursuits was all mystery, all idle surmise, until the aid of science dispelled the cloud.

Where the investigations have been so extensive and so important, it is impossible to condense in the brief outline, to which I must now necessarily be restricted, all the points that are essential to illustrate the views I propose to submit. For some years past, throughout each season of the year, I have minutely investigated all the causes that influence the

several stages of growth of the *Salmonidæ*, and their habits, and during the past and present winters have explored the spawning beds of the salmon in the wildest retreats of the country. I propose, therefore, to give the subject under the following heads :—

1st. The natural habits of the salmon, its spawning states—the parr and the gravelling.

2ndly. The seasons with regard to several of the rivers of Ireland.

3rdly. Remarks on weirs and fixed engines.

So much has been said, and so many treatises have been written, respecting the peculiar habits of the salmon on the approach of the spawning season, that I shall not examine whether the male fish first ascend to the spawning beds, and are the first to retreat, leaving the female to complete all the labours of depositing and protecting the ova, but shall give such observations as actual investigation during the past and the present winters have enabled me to make in the remote districts of our wild alpine streams. The periods of spawning vary according to the earlier or later seasons of the several rivers that salmon are peculiar to, embracing the months from September to the month of February. To the seasons of those rivers I shall refer in another section of my paper. Instinct guides the salmon to select beds for the depositing of the ova, where, in the shallow current of the stream, the gravelly strata afford necessary security, and for due maturation throughout the varying changes of winter, unless disturbed by more than ordinary floods.

On these beds the parent fish can be observed carrying out all the duties of placing in safety the ova of their future progeny.

Closely watching the operations of a pair of salmon, I noticed the female fish plunging and forcing her head into the gravel against the stream, and with but slight intermission continuing her exertions until a sufficient furrow had been made, by turning the gravel on either side. When sufficiently completed, the expulsion of the ova was effected in the channel of the furrow, the male fish apparently assisting. The female then dropped down the stream, and the male fish was observed to be working violently over the furrow, in fact covering the ova with the milt, and forcing the gravel over the channel of the furrow. In this action it repeatedly worked on its side, and seemed to force, or shove, with its back the gravel to complete the covering of the ova in the furrow. The same operations are continued in the formation of other furrows until all the ova of the female are deposited, when the fish again retreat to the deeper pools to recruit. When the maturity of the spawning state forces the fish to seek the shallow streams, their conditions and appearance have strangely altered. The male fish, like birds in the nuptial plumage, has assumed a gaudy tinge. The operculi, or gill covers, are beautifully mottled or spotted with orange, white, and olive-brown, and with gaudy streaks of orange. Large spots of a vivid crimson and orange are along the side, above and below the lateral line; the abdomen, a reddish or yellowish brown; and the head appears of a more elongated form, the hook in the mandible becoming enlarged and conspicuous. The female has not those vivid markings, but assumes a dark and yel-

lowish appearance. After the operations of spawning are completed, the fish seek the earliest floods to retreat to the sea, and the longer they are detained in the fresh water, the more dark, unsightly, and attenuated they become; and so remarkable is the effect on the male fish, that its form could scarcely be recognisable as the beautiful object it presents in form and brilliancy of silvery scales on its first ascent from the sea. The male fish especially pines, the cartilaginous hook in the lower jaw elongates and enlarges to such an extent as to force a deep groove or fausset in the upper jaw between the premaxillaries, where it lodges as in a socket. In this unhealthy state, which prevents the closing of the mouth, the fish is termed a "Curraghabaugh." A remarkable character in each fish is the enlarged and flabby state of the adipose fin. To satisfy myself fully respecting these conditions of the fish, I captured several on the spawning beds—I was fortunate in taking both the male and female fish from the beds after spawning, and had sufficient time to examine each before returning them in safety to the water. The male fish had its back much mutilated, both anterior and posterior to the dorsal fin, and its sides were deeply scored by its action on the gravel. The dorsal, and ventral fins, and a portion of the caudal fin, were much torn, and the dorsal fin was coated with the milt, as if coming in contact with the shedded milt, when covering the furrow. The female fish had the snout and forehead much excoriated. In several of the streams where the spawning fish were at work, I could observe the mutilated appearance of the backs of several of the fish when swimming about. The period of the season when the ova are deposited, the state of temperature throughout the winter, are varying causes as to the time of extrication or liberation of the young fry, which generally may be considered from 110 to 140 days. For a period of three or four weeks, the young fry is sustained through the nourishment of the vitelline sac; and when freed by the absorption of that appendage, it seeks its food in the shallow streams of the fords, and the spawning beds, until its growth in twelve months brings about the important change in its life. Previous to that change it is known as the little barred fish called the parr, about which so many, and such contradictory discussions have taken place. However, to the shame of science, but little attention had been directed to its characters, until the experiments, during the years 1833 and 1834, by Mr. Shaw, of Drumlanrig, proved the singular changes that that little fish underwent until its growth to the mature salmon.

A correct knowledge of the natural history of the salmon is of essential value in an economic point of view. Much of its history has by many been supposed to be a mystery, and many fallacies have been advanced in consequence of the imperfection of knowledge respecting the habits of growth of the several species of the "salmonidæ," which, in the young state, so closely resemble each other. It is indeed of importance to be able readily to ascertain, among all the characteristics that distinguish the several forms, those that actually belong to the true "salar." The names parr and gravelling are unmeaning and incorrect names to apply to the true salmon fry, for both are applicable to, and are identical with,

a true species of trout. Hence very much confusion has arisen with non-practical "savans," by confirming too often such mistakes, without practically being acquainted with the varied forms that the Salmonidæ present in their young state. In the first edition of Yarrell's "British Fishes," p. 42, the parr or samlet therein figured is not the young of the true "salar," or salmon, but a species of trout peculiar to clear and swift running streams and rivulets, and it is as often met in streams where no salmon visit, as in those tributaries where salmon spawn. Its peculiar form, and the characters of its pectoral, ventral, and caudal fins, at once show it to be distinct. Besides, after the true fry has assumed the smolt state, and gone its downward course to the sea, the parr and the gravelling are found throughout the season. The extrication from the ovum of the fry generally takes place in the month of March, or of April, according to the earlier or the later periods of the depositing of the ova, and of the temperature of the water. In the following year (twelve months) the young fry assume the silvery dress of the smolt state, and in the month of May the greater part have departed to the sea. There may be exceptions to the general law—such as may be observed in migratory birds; delicacy of growth and other causes may influence them to remain behind, but the great change of the salmon fry is assumed at the age of twelve or thirteen months from the time of liberation from the ova. Still misgivings have been entertained in the experiments of the Stormontfield ponds, where numbers of the fry did not assume at the annual period that change. These deviations from the true laws of nature are more likely to be results influenced by artificial causes, and not decided tests that the fry in their natural state necessarily remain two years in the fresh water. The terms parr and gravelling, as applicable to the young of the true salmon, should be set aside, and the appellation "salmon fry" alone used.

In the month of June, 1854, I gave a paper upon the several states of the young of the "salmonidæ," exhibiting specimens of the different species.

The parr, or samlet, is deeper in proportion to its length than the salmon-fry; pectoral fins less elongated, and paler in colour; the caudal fin less deeply forked, the terminal points more rounded; the body silvery, yet different in its markings, and the bars are retained in that little fish, as well as in the charr (*Salmo salvelinus*), longer than in other species of the trout family. In the month of June I obtained in the salt water in Dingle harbour, the young of the white trout (*Salmo trutta*), with the bars well marked, being but partially covered with the silvery scales.

Having so far marked the progress of the fry, we find that in a period of from six to eight weeks, its growth in the sea has been, by the nourishment it obtained there (its essentially vital principle), increased to four and to six pounds in weight, thence returning to the fresh water a salmon peal or grisle. In that condition of life it goes through all the stages of spawning in its native river or tributary, as in the adult fish, and returns again to the sea a grisle or peal. That the fish never returns to the sea a grisle, but attains the adult state of the salmon in

the fresh water, is an erroneous assertion. In the month of January, of last year, I took from a river in Kerry, peal, after spawning, of three and four pounds weight, and having all the characteristics of markings as shown by the adult fish in that stage; but they were truly peal returning to the sea at the first favourable fresh to recruit their exhausted condition. In a few months they revisit the river, largely increased in weight, and are adult salmon. Brackish water is supposed to be necessary as a resting medium, on the passage to and from the sea, and it is thought to relieve the fish from the irritant effects of the parasites that attach themselves to it. In several of our western rivers no estuaries or brackish pools exist, no commingling of the ocean tide with the river that trickles over the shingly barrier; but the impetuous river floods rush over the opposing bounds to the sea, and liberate or give access to the fish tarrying for that change. The *Caligula piscinus*, or lernea, attaches itself to the fish, and the gisler, or *Brachialis salmonia*, adhere in numbers to the gills of the spawning fish. All animals and birds, in the most healthy state, are infested with their peculiar parasites and species of entozoa. The parasites of the salmon are no exciting cause to hasten its changes from the sea, or the contrary.

The next portion of my paper will be with reference to the seasons of salmon, and to the peculiarities of several of the rivers of Ireland. On the erroneous opinions that are entertained with regard to the habits and peculiar growth of the salmon, are perhaps founded the strenuous claims made by the river heritors that the salmon is as much their property as the banks of the river, or the pigeon of the dove-cot, and that the true residence of the salmon is the fresh water. These gentlemen forget altogether the changes that are absolutely essential for the full development of the fish to its perfect growth, and for that state of health and vigour which it requires before its ascent to the higher portions of its river, to form its spawning bed for the deposit of the ova and the future locality of the fry. It is only in the sea that the salmon in the course of six or eight weeks acquires or gains a growth of as many pounds in weight, attains that firmness and fine flavour of the flesh, its clear and silvery brightness of the scales, while in the fresh water all its energies of growth and development are for a brief space stationary, rapidly declining as its stay is prolonged in the river; and after it has accomplished all the functions of the spawning state, the fish becomes unwholesome and unsightly, and pines until it has secured its retreat again to the ocean.

The river proprietors may claim the wages of the nurse, but those of the coast its nourishment to maturity. The species of shad, *Alosa finta*, and *Alosa communis*, might equally be considered a fresh water native. These fish frequent the salt water estuaries and bays of our coasts, but ascend the fresh water in the spawning season, where they remain for two months. Thus they are frequently captured in the salmon nets, in the lakes of Killarney. Salmon do not at all times enter the fresh water for the purpose of spawning. The spring fish of the year, in many localities, run up from the sea in the months of December and January, in

the finest condition. These fish return to the sea in March, without spawning, to renovate their condition, and are again in our rivers as the early breeding fish of the autumn. Anxious to trace the correctness of these views, I examined during the months of December and January, for several winters past, those spring fish which ascend our early rivers from the sea, and found them in the finest condition, and destitute of ova or milt, or with these in a rudimentary state. These fish, generally of large size, returned again to the sea, not ascending the rivers to spawn until the month of August following. They were generally in full development of the spawning condition in September, and are our best breeding fish, but as spring fish they only abide in the fresh water for a limited period. Their condition at that season does not stimulate the development of the ova. All anglers are anxious to kill a new run fish; and throughout the seasons, the spring and early summer floods, and Lammas rains continually give runs of fish according to the earlier or later periods of the seasons of a river. Salmon are constantly changing as the river freshes give them freedom.

Rivers connected with large lakes are of a temperature that encourages the earlier ascent of fish, and those that flow from springs or alpine streams are late, as to the ascent of the salmon, and to the periods of breeding. To establish uniformity of the close seasons because such rivers exist in the same district is an absurdity, and a direct injury to a river, as well as to the proprietor. It deprives the public of the advantage of the finer condition of the fish of our early rivers, while it is equally destructive to the spawning, and to the spent fish of our late rivers. To these conditions of several of our rivers I shall presently briefly allude. Feeling it desirable to satisfy the opinions I had formed, I communicated them fully to Andrew Young, of Invershin, the most experienced practical man in the salmon fisheries of Scotland, the manager for nearly half a century of the Duke of Sutherland's Fisheries, in Sutherlandshire. I give the following extracts from his letters:—"Your views with regard to the parr are quite correct, and so are they with regard to the early salmon that ascend our rivers; for they do not spawn before returning to the sea, and those who say so do it from mere imagination. Several years ago I got a large pond erected, which was fed by a stream of water taken from the Shin, and all small fry and insects that the river contained had free access to the pond. On the first of February, I put three fine new run salmon, none of them under fifteen pounds weight, into the pond. I kept these salmon there until October, and then examined them, when I found them getting gradually lean as well as dark. On examination I found they had no appearance of spawn, neither milt nor ova; in fact, the spawning organs in both sexes had only the appearance of a half-dried earthworm. When we had cruives in the river we took them out in July, and found that numbers of salmon, exactly resembling those I had in the pond, had collected in the pool above the cruive dykes. These fish got down the river when the cruives were removed, but numbers were taken in the nets further down the river. Some of them I also examined and found exactly to

correspond with those confined in the pond. Now, from these facts, and attentive observations, I have no hesitation in saying, that all the early winter and spring salmon that ascend our early rivers in such fine condition must return to the sea before they can be fit to spawn.

"We have sixteen salmon rivers in the county, some of which have fine clean salmon in December and January, and some have no clean run salmon sooner than the first of May."

These are sound practical views, which such men as Young, of Invershin, and Dunbar, of Loch Inver, can give. This has been proved by the examination of the salmon of the Caragh, in Kerry, one of the earliest rivers in Ireland. In the month of November, the Commissioners of Fisheries had seventeen salmon taken in the cruives—"fifteen were the most beautiful and marketable fish that ever were seen." The ova and milt were not developed, for they were in a rudimentary state.

Thus, by the uniform seasons of a district, the proprietor is in one sense legally deprived of the advantage of his early fishery, while on the other hand the extension of the open season is decidedly injurious to that fishery. Again, as in the instances of the Bandon and the Slaney, the open time commences to the injury of the spawning and spent fish; and the river proprietors, by an unnecessarily early closing, are deprived of the value of quantities of clean run fish, which in the former river continue throughout October, and in the latter to the month of November. I have taken salmon with a cullock, or loach (*Cobites barbatula*) in the Slaney, near Newtownbarry, in fine condition in November.

Stringent regulations, and heavy penalties imposed on the capture and exposure for sale of foul fish, should be fixed and enforced throughout each district; for if such were not effective, neither would they cripple nor prevent the excessive poaching that still, in the close seasons, largely prevails in some of our best salmon rivers and their tributaries.

There are about 140 salmon rivers around the coasts of Ireland, the greater number being named and included in the seventeen districts forming the boundaries over which the fishery laws are supposed to be exercised. In these several districts so varying are the seasons of many of the rivers, even having close proximity with each other, that no satisfactory advantages can be consequent on the allocation of a uniformity of law. There is no sound reason to accuse our fishery laws for allowing the exportation of unsound fish (not to speak of the destruction to the parent fish), since the present laws, are sufficiently strong to restrain all poaching, and to seize all illegal captures for exportations, were these laws only enforced.

Nature, ever bountiful in her supplies, yields to us throughout the seasons, in both inland and sea fisheries, her delicacies each month of the year. Thus, in nearly thirty rivers, fine spring fish, in the primest condition, are ascending the rivers, during different periods of the months from November to March. Many of these rivers have short courses in connexion with large lakes, such as the Caragh, the Curraun, and the Laune, in Kerry. The first produces splendid salmon from November, throughout the winter; the two latter, from December to February. The

Munhim, in Mayo, and the Bundrowes and Rathmelton, in Donegal, have the primest salmon from Christmas out; and also the fishery of Lord George Hill, with several others that have early runs in February. The late rivers, as the Slaney, the Bandon, Lee, and the Maine and Fertagh, in Kerry, preserve the supply late in September and October, while the general run of the rivers afford constant supplies throughout the summer. Many of our alpine rivers are very late, so that the salmon do not leave the estuaries or tidal parts until late in summer; and in many of the smaller rivers, do not enter them until they ascend to spawn. In all those early rivers, early closing of the season is of essential importance to the protection of the breeding fish; but, on the other hand, in such rivers where the seasons are peculiar, as in the Slaney, the Bandon, and the Aragadeen, it would be injurious to permit an earlier opening than late in March, especially when it would be judicious and necessary to extend to them the open season much later in the year. Our coast fisheries present the same valuable features of constant supply; for on the south-west our soles and turbot are earlier than the west, the west than the north-west, and on the east coast much later again. So that, by proper adaptation of laws and encouragement to our fisheries, supplies throughout the season should stock our markets.

In taking into consideration the several seasons of the salmon wherein failures or decrease in the fisheries have occurred, the general outcry is raised against all fixed engines, and the prophets warn us that each current year will present the utter extinction of the salmon. No doubt the gapless weirs that too numerously bar our rivers around the coasts of Ireland—the "illegal positions" of fixed engines, stake nets, and stop nets, with the unmerciful use of sweep nets,—but, above all, unmitigated and unrestricted poaching, may diminish the great supplies that our rivers would otherwise give, yet there is never contemplated the fact that seasons favourable and unfavourable may tend to the causes of increase or diminution. More than ordinary floods of a winter may injure the spawning beds; and a dry season, on the other hand, may retard the ascent of the fish when the development of the ova stimulates the desire to enter the fresh water. The remarkably dry summer and autumn of 1850 seriously affected all our rivers, not only in Ireland, but in Scotland, and was the worst season on record. With rains and floods in summer and autumn, our rivers become abundantly stocked, at least where no obstructions in rivers exist. The favourable season of 1861, and the equally favourable winter of 1861–2, will yield us abundance of fish for the year 1863. When dry seasons affect our rivers, and the salmon cannot return to the sea, or leave the estuaries at their usual periods of ascent, epidemics, as well as destructive enemies, will thin their ranks. Equally so our game preserves, and our moors, are affected by cold and wet seasons at the breeding periods. The sunless season of 1862 has been injurious to the growth of the young birds, and disease and epidemics have affected them in many districts to a serious extent. "The Field" newspaper, and "Bell's Life," of August last, proclaim such fatal decrease in

numerous localities. Seasons remarkably affect even our domestic poultry; for I believe the last year has not only been fatal to our breeding birds, but their eggs have very generally proved unproductive or abortive.

I will now offer a few remarks on fixed engines, and other modes of the capture of salmon.

In these statements I trust I shall put the matter in a fair position before you, not advocating unjustly one side or the other, but most firmly, in all fairness of principle, demonstrating the teaching of science and experience in opposition to the illiberal and untenable views which are interesting parties against all lawful means of public right, as well as of public advantage.

The Act of 5th and 6th Victoria, c. 106, called the Act of 1842, seems to have been framed with great care, under the most influential approbation, by the most experienced legal authorities. Further to enforce its objects, four subsequent Acts, as amendments, were introduced and passed, which combine and afford all the necessary protection that our inland and sea fisheries require.

These laws, in the opinion of Mr. Barry, the most experienced of our Irish Fishery Commissioners, were amply sufficient to carry out all the objects that were intended. The following is an extract from his report which appears in the Appendix No. 4 of the Select Committee on Fisheries, Ireland, 1849:—

"I am far from thinking that the Act 5th and 6th Victoria did not contain matter and confer powers which I had hoped to see turned to purposes of improvement, as well as of regulation of the fisheries of Ireland. Its provisions with respect to the salmon fisheries exhibit, I assert, a most consummate knowledge of the subject, and taken on the whole, would, if vigorously administered, constitute as judicious a code as could have been framed to meet the various conflicting interests concerned, and the perplexing difficulties of that important branch."

In contradiction to such sound views, and indeed of one who took a prominent part with the Commission of 1835, in the very elaborate investigations into the state of the Irish fisheries; parties have advanced formidably to sweep away all those codes, and have almost annually introduced bills to Parliament for that object. Amongst the most prominent was that of Mr. Anstey, introduced in February, 1850. This bill contained 180 sections. It proposed to enforce "free gaps, or Queen's shares, in all lawful weirs (but provided compensation). Engines were not to be fixed so as to injure common fishery or navigation—free passages of fish, &c. Provided all passes for the safe migration of, and protection of fish, fry," &c.

Mr. Anstey, as a lawyer, had stated in the House of Commons, that all fishery charters dated since the reign of Queen Elizabeth were illegal. This bill was violently opposed by a numerous body of influential river proprietors, by resolutions at several meetings held at Londonderry and at Ballina.

In February, 1852, Mr. Connolly's bill contained equally stringent sections.

In March, 1853, a short bill was introduced by Mr. M'Mahon "For the improvement of the Irish fisheries," the principal features being the "extension to Ireland of English statutes." And again, in 1862, most sweeping views are advocated to enforce all sections of the preceding bills, but without saving clauses to vested rights or compensation.

The most singular feature in these proceedings is, that parties who are now most strenuously upholding and endeavouring to carry the principles of Mr. M'Mahon's bill, were those that opposed Mr. Anstey's bill as *unconstitutional*, and interfering with vested rights.

There are nearly forty weirs extending entirely across rivers in Ireland, the greater number having no Queen's gaps. In fact, the numerous rivers extending from the north, and west about, to the south-west coast, are barred with weirs, generally of stone, and some where the rivers are so narrow as only to be fished with one box. Some of those rivers are of great value, connected with important lakes, which encourage an early ascent of fish, while in neighbouring rivers in the same district, salmon do not enter until late in the spring or early summer.

The enforcement of a permanent Queen's gap would be destructive to the fisheries of the owners of such rivers as the Curraun, the Caragh, the Newport River, Bundrowes, Munhim, Buncrana, Gwebarra, and Ardara, and sundry others similarly circumstanced, held by charter, grant, or prescriptive right, or for a long period of years. Where no compensation could be arranged, the provision for an extension of the weekly close time, twenty-four hours, as contemplated in Mr. M'Mahon's bill, in all weirs not having Queen's gaps, ought to satisfy the weir-holders, and would be fair to the river proprietors or riparians.

In the evidence before the Select Committee of the House of Commons, 1862, much stress is laid upon the improvement of the fisheries of the Messrs. Ashworth, at Galway, by the enforcement of a Queen's gap in the weir. These statements are the hacknied expressions of the fixed-engine abolitionists. Now, what are the facts? The old weir, that ran entirely across the river, at the time the Messrs. Ashworth purchased the fishery, had no gap. It was, in fact, a dam for preserving a certain supply of water to the milling powers in Galway. The Commissioners of Drainage found it necessary to provide for a better egress for the water of the lake, so as to prevent the inundations that occasionally occurred. The netting of the fishery below the weir was good, which led to a litigation on the part of the Messrs. Ashworth, in opposition to the formation of a gap; but in which they were defeated. On reconstruction of the weir, when the gap was formed, it was necessary to construct a regulating weir at the entrance to the lake. This weir has sluices, so as to regulate the body of the water coming from the lake, and to retain a proper supply for the mills. A fish-pass, or stair, is formed over the weir, which certainly allows in heavy freshes the fish to pass freely to the lakes and the streams connected; yet during dry weather in the open season, the greater proportion of the fish are kept in the reach between the first weir and the regulating weir. In the first weir the gap is in the deepest part of the stream, being sixteen feet in

width. Two cruives, or fish-boxes, are on each side of the gap. The consequence is, that a large quantity of fish can readily be secured by nets, especially in the long reach between the weirs, as well as at favourable times a large number taken by the rod. 3085 fish were taken by the rod last season, between those weirs, the greater number principally between the court-house bridge and the regulating weir. So favourable is the promise of a large supply of fish the approaching season, that an additional five pounds has been charged—the price of the season being £35 for each rod, or ticket issued. This has, therefore, become a most valuable fishery, the gap securing the great run of the fish between the weirs. The Messrs. Ashworth deserve the highest commendation; and under the excellent management of Mr. Miller, they have throughout the season a constant supply of marketable fish in fine condition,—an abundance of amusement for the angler; and, above all, the excellent system of protection, and keeping up the stock of brood fish, render the fishery a permanently valuable property.

With reference to stake weirs and other fixed engines—stake weirs were first introduced about the year 1820. The conflicts that arose among the fishermen and cotmen of the estuaries of Waterford and of the Shannon caused serious inquiry as to the injurious effects inflicted on them by those successful appliances. The Act of 5th and 6th Victoria only legalized them under certain restrictions; and enforces such limitations, that, were those sections of the Act duly carried out, there could exist no just grounds of complaint for their establishment. For several years I had been cruising in the Shannon, and was acquainted with its shores to its entrance. Stake weirs were numerous, yet I never knew instances of their interruption to navigation, or injury to the fisheries. They are generally, of necessity, fixed where strength of tides, rocky shores, or deposits of mud, as in Clanderlaw Bay (merely an inlet off the Shannon), prevent all use of drift, draught nets, or seines; and it has been clearly shown that in many localities where those engines are used no species of draught net or seine could be worked. Thus, at a most influential meeting held at Waterford, in January, 1852, it was proved, "that for the lower twenty-one miles of the rivers Suir, Nore, and Barrow, except for an intervening space of about two miles occasionally fished by drift net fishermen, no means exist of taking salmon except by fixed engines—the particular formation of the banks of those rivers, in addition to the depth, current, and rapidity, preventing any other mode of fishing them being ever even attempted."

That meeting passed a resolution, declaring—"That such fixed engines would be advantageous to the public, in affording a constant supply of the primest fish, especially in the early part of the season, before such fish frequent the upper rivers, and become of inferior quality."

The evidence of Mr. Brady, Inspector of Fisheries, before the Select Committee of the House of Commons, asserted that the stake weirs of the Shannon supplied a large quantity of salmon to the market in the finest condition.

Now, with reference to that noble river, how could drift nets and draught nets be used in great portions of its tidal course? In these days of enlightenment we require the information of practical and scientific men, to decide the points of its fisheries and of its navigation; and we should not be misled by the absurd prejudices of ould fishermen, and men of hookers and turf boats. How loudly the outcry has been raised against those fixed engines may appear from the formidable display their opponents have given, on a sheet exhibiting a summary of 125 fishing engines, along the shores of that estuary; and so destructive are those engines stated to be, that a letter from Limerick in "The Times," of the 8th of May, 1862, complains that large numbers of boxes have been sent from the lower Shannon, containing nearly twenty tons, and that railway waggon-loads are every morning conveyed away. Whence, then, originates the existence of all those fish? If we accept the views of one of the talented honorary secretaries of the "Association for the Improvement of the Irish Fishery Laws," given in "The Field" newspaper of the 29th of November last, "that salmon spawned in the tideways," surely it cannot be denied that the coast proprietors are mainly entitled to those fish; and if, on the other hand, the river heritors are the nurses, they have had sufficient to satisfy them, else there never could have been the multitude of breeding fish allowed to pass which have afforded such contributions of progeny to the lower waters. I admit that fixed engines should not be placed in narrow estuaries, or where at the mouths of rivers the river and fresh water exist with predominating influence; but in the tidal portions of such an inland sea as the lower Shannon it is monstrous to suppose, that where stake nets and fixed engines are placed, and where the law does not specifically interdict their use, that they should not be exercised commercially for public benefit. The most important view, which can be confirmed by those who scientifically and practically understand the natural history of the salmon, is, that those fixed engines can never be a detriment to the increase of that splendid fish. The period of the open time can never interfere with the spent fish of the previous season; and the early closing, on the 6th of July, in the Limerick district, is earlier than the time that the salmon are in a condition to seek the rivers for spawning. Yes, but the cry is, that all the salmon have been taken before the season has closed. Whence, again may I ask, proceed all the large quantities that have been supplied, and those that are largely increasing in our rivers, and will in 1863 be fourfold? From Galway, Ballina, the Foyle, and most of the principal rivers, we hear those cheering accounts; indeed, where protection is afforded to the upper waters, increase is certain.

The closing of the seasons in the Irish rivers has been most cheering: abundance of fish is announced as appearing in all the streams that are protected. The favourable states of the water and weather during the seasons of the last two years have multiplied the fish exceedingly. I quote a few paragraphs:—

"The takes of the salmon this week along the coast of the Foyle, in the Bush, and in the Bann, have been unusually large. The number

said to have been caught in our river is almost apocryphal. Foyle fish have been selling in Derry all the week, at 6d. per lb."—Coleraine Chronicle, 5th July, 1862.

"The number of salmon taken here this week is quite unparalleled. The river swarms with salmon."—Ballina, 15th July, 1862.

"The town has been supplied with abundance of salmon this week, at 7d. per lb. The quality of the fish has been first-rate."—Sligo Chronicle, 12th July, 1862.

Turn to the Scotch rivers. "The close of the Tay salmon fisheries has proved to be the most successful and remunerating to the tacksmen, especially on the lower stations, that has been experienced for several years. The trout are more numerous both in the Tay and Earn, than they have been for several years past."—Dundee Courier, August, 1862.

"'The Scotsman' says the Tweed is literally swarming with fish. Last week, while the river was in flood, they were to be seen literally in hundreds, splashing and bounding up out of the water at the heads of streams, as they eagerly pressed on for the upper waters."—October, 1862.

Compare the foregoing with the account taken from "The Berwick Advertiser" of October, 1850, when the arid season of the summer and autumn left the river almost destitute of fish—"That the opinion seems to be that nearly the rent of the Tweed (£6,000) has been lost, and that the produce has only remunerated the cost of labour."

Excessive poaching and netting throughout the rivers of Ireland in the close season, especially on the spawning beds, when the rivers are low—the inefficiency of the penalties imposed, are the causes of the great destruction and diminution to the fisheries of our rivers.

In the voluminous evidence given by Mr. Ffennell before select committees, poaching, as a universal evil, sounded throughout. The cotmen, and net fishermen, with snap nets, cause to the waters of the upper Shannon, the Slaney, Suir, Nore, Barrow, and Bride, as well as to the Blackwater and its tributaries, serious injury by their illegal fishing. On Sunday night, the 28th of September last, twelve fishermen of New Ross were caught fishing for salmon, contrary to the Act.

"The Carlow Sentinel" of September, 1861, attributes the unproductive nature of the salmon fishery in the Barrow "to the destruction during the spawning season, to liming the rivers, and netting the fry in such amazing quantities at certain points."

Mr. Brady's evidence of the destruction of large fish on the spawning beds in the Liffey, proves that with proper protection, and stringent regulations with regard to weirs and passes, the Liffey would be a splendid salmon river from the early ascent of large spring fish.

Mr. Little, of the Ballina fishery, has remarked—"That the greatest defect in the present fishery laws is, that they are not sufficiently stringent against poachers in the close season, salmon being killed while spawning in enormous quantities." Mr. Little is stated to spend from £800 to £1000 a year in protection alone, independently of any funds which are subscribed by the Board of Conservators.

The Bush River that I have before alluded to abounds with salmon and trout, in consequence of the proper protection of the upper waters, and notwithstanding that a more extensive bag net fishing, draught nets, and seine drawing, existed in the Ballycastle district than on any part of the coast of Ireland. At the important salmon fishery inquiry in Galway, on the 26th of August last, Mr. Miller, the intelligent manager of the Ashworths' fishery, stated—"Protection is the whole secret, for without breeding we cannot get stock; 86 men are employed watching, &c.; protection was the great secret of the increase."

Some few years since, at a fishery meeting at Ballina, at which Colonel Knox Gore presided, it was stated—

"In giving special causes for the decline in the salmon fishery, no cause is more prominent than that of the absence of efficient and sufficient protection to the brood fish, the stringency in the guarding of which we look upon as much more important than any mere infringement of the law in the open seasons."

Another serious evil is the undue liberty and absence of restriction on systems and periods of netting in our fresh water lakes and rivers, as well as in some of the tidal portions. Sweep nets and seines of extensive lengths and depths are used in our lakes; rivers are destructively netted; and in the tidal course a series of nets are shot across from bank to bank or shore, and as each net sweeps a pool, succession lines of nets bar all passage.

The 36th section of Mr. M'Mahon's bill provided against such detrimental injury. In several of our lakes a too early permission is granted in the use of nets for the capture of salmon, and at a period when from the tributaries numbers of spent fish are returning to the sea. When, in 1844, the close time was enforced in the weir at Caragh, the lake became filled with fish, which induced the proprietors to lease the fishings of their shores. It has been questioned whether such liberty (in accordance with the law enacted in 1842) to fish with nets could be legally transferred or authorized by the proprietor, even if the fishery were a several fishery. A striking proof of the usefulness of protection to rivers is that mentioned by the proprietor of the River Inver, in Donegal, in "The Field" newspaper of 21st June, 1862—Inver Bay was studded with bag nets, and Inver River became profitless. Salmon became so scarce in 1857, that the river did not pay its expenses. The proprietor resolved to give it a jubilee in 1858, and accordingly no fish were killed in that year, save with the rod, or a few for the supply of his own table. The consequence was, that in 1859 the receipts of the river were trebled, reaching to £105. Those of the bag nets increased in the same ratio. The same valuable returns resulted to Lord Arran, when he turned attention to preserve his river. Despite of all the bag nets, there is excellent fishing in the lakes and rivers of Donegal.*

In conclusion, I cannot but view the principles of Mr. M'Mahon's

---

* See Mr. Ffennell's evidence before Select Committee, 1849, question 4129.

bill to be strongly indicative of an unfair and exclusive support to the river proprietors, and to sporting and angling interests. Yet I am far from denying that better legislation should not be assumed, and that the statutes of George III., with reference to royal patents, should not have such corrected regulations as would compensate and benefit private and public rights, and afford that fuller development to our fisheries which the requirements of the public good demand.

It has been remarked that the rights of proprietors of the upper waters are private, and those in which the public have no interest or share, and that they are completely in opposition to all useful commercial systems of fishing for public benefit. It is a creation of monopoly for themselves, and with the object of leasing out those fisheries for sporting purposes.

I do not suggest that where large sums have been expended in the promotion of such fisheries as at Galway, Ballina, the Bush, Gweedore, and at Ballinahinch, full protection of the law should not be established; but, as a general principle, it would be to close all rivers and estuaries against the public, would curtail commercial enterprise; and the amateur angler, who may have but few days at disposal, would be scared from the river bank, for the river proprietor would have the same right to charge him, as Mr. Brady's evidence proved, "that a man has to charge another for grazing his cow." Mr. Commissioner Barry gave a sensible opinion at the meeting held at Bandon, on the 21st of August last, "that fish ought to be taken anywhere and at any time that they were in prime order, provided that sufficient stock was allowed to go up the rivers for fructification;" and that it "was clear to him that the persons who fish with rods are generally not a class of people who fish for market—those who fish with nets fish upon a large scale, and for market."—Cork Constitution, 22nd August, 1862.

In the evidence given by Mr. Ffennell before the Select Committee, in 1849, "He agreed that the great increase in the salmon fisheries was due to the introduction of stake nets, and improved method of fishing with draught nets, and the establishment of more vigilant and effective systems of water keeping."*

Surely the river heritors cannot complain of such improved systems, when in the Limerick district they are employed but scarcely four months of a season, while the fishing season enjoyed by the sporting interests exceeds seven months.

In the foregoing statements I have alluded to the several modes of capture, and to the engines employed, and I do not consider that I have ventured to advocate unfair or unjust principles. Stake nets, throughout my remarks, were the engines referred to; bag nets should have limitations to their disposal, but it must be obvious that in Donegal Bay, in such estuaries as Loughs Foyle and Swilly, and the Shannon, they could not possibly be injurious; but, on the other hand, during the period

* See 4452, and following.

of the season that their use is legally permitted, they supply our markets with fish in the finest condition, and cannot, in consequence of their generally early closing, injure the ascent of sufficient numbers of fish to the upper waters. Portions of several of our larger rivers can only be fished by means of fixed appliances. The Act of 1842 contemplated the most stringent restrictions on the undue use of all fixed engines, that were not under the conditions of the Act legalized; and it was also held in view that a proper defining of narrow estuaries, and the mouths of all rivers, should point out the proper bounds for the placement of all such engines.

I will conclude by an extract from a paper read by Mr. Ffennell (the distinguished Chief Commissioner of English and Scotch Salmon Fisheries), "On the Propagation of Salmon:"—

"He felt the necessity of bringing those inquiries before the society, as those who were engaged in the experiments were practical men, without scientific knowledge, and who therefore laboured under the difficulty of not being able to solve any new features that presented which a knowledge of the natural history of the animal and the aid of science might explain, and consequently enable them to take advantage of. He (Mr. Ffennell) did not understand the fisheries scientifically, but he had been practically engaged for many years. He was a practical man; but he was fully sensible of the importance of the study of natural history, and that 'science must promote practical knowledge.' The aid of those who made practical science their study would be of great value in carrying out the work of public or official bodies."

The Chairman (Rev. Professor Haughton) said he was sure he only expressed the unanimous opinion of the meeting when he said that it always afforded them the greatest possible gratification to receive a paper on our fisheries from the distinguished President of the Natural History Society of Dublin. It would be in the recollection of many present that one of their most valuable papers during the last winter was that contributed on the cod fisheries of the coast of Ireland by Mr. Andrews, and he had added to the obligation which they owed him by bringing forward his present paper. Mr. Andrews was quite correct in stating that each different river should have its close season and open season, according to the laws of nature. Their lawgivers required certain rivers to be closed at a certain season, and open at a certain season, which probably benefited the proprietors more than the fish, and they owed a great deal of the mistakes of their fishery legislation to the preponderance of lawyers, and to the absence of naturalists, in the House of Commons. The laws which the salmon observe ought to be understood, and made the basis of laws made to regulate the rivers. When Mr. Andrews informed him that he was going to bring forward his paper, he told him that he would write to a friend in Norway (Mr. Merck, the British Consul at Christiansand), in order to ascertain whether they were anything more enlightened there than we are ourselves; but he found that, while they were more enlightened in one respect, in another they were as backward as ourselves. This gentleman wrote to him from Christiansand as follows:—

"The total export of salmon from Christiansand in 1861 amounted to 90,000 lbs. The regulations for using nets vary for the different rivers; generally the landowners have the right to put their nets half across the river, at a certain distance, so as not to

interrupt the communication. When no stationary nets are put out, the farmers or landowners have each their day to drag their nets. No salmon or sea trout fishing is allowed from the 14th of September to the 14th of February; likewise is the fishing prohibited from six o'clock on Saturday evening to six o'clock on Sunday evening, during the season."

The CHAIRMAN concluded his observations by again stating that they were under great obligations to Mr. Andrews for his admirable paper.

MR. JAMES HAUGHTON said he remembered that some fifteen or twenty years ago the flour-millers of the country were very much interested and irritated at the course then about to be pursued by the gentry of the country who were the proprietors of the salmon fisheries. It was alleged that the mill-wheels destroyed a great number of salmon, and suggested that iron grating should be erected at the head and tail of the wheel. Whether that was ever carried into effect he knew not, but he knew the millers were greatly opposed to it; and in any further legislation on the subject that matter ought to be taken into consideration.

MR. JOHN A. BLAKE, M. P. for Waterford, said, that anything coming from Mr. Andrews and the Society would, of course, be treated in Ireland with the attention which anything from one of the most learned bodies in the country deserved; and therefore it was the more desirable that any opinions of what he would call a pernicious character should not be passed unnoticed. He entirely dissented from some of the propositions laid down by Mr. Andrews. It was quite evident that that gentleman entertained a feeling rather in favour of the continuance of fixed engines; and also, from the approbation with which that expression was received, it was evident that he had impressed his audience in the same direction. In the first place, he wished to correct Mr. Andrews in a few mistakes as to matters of fact. He had not correctly stated the fact with regard to Magna Charta; but he believed that the idea he expressed, unfortunately for the poor people, was acted upon. The next error was that Mr. M'Mahon's bill was cut down to two clauses at the end of the session. It was not cut down to two clauses, nor to ten times two; it was greatly curtailed, no doubt, but not so much as Mr. Andrews had stated. Mr. Andrews also spoke of the salmon being obliged to go to sea, and said that it was not, of course, a fair thing for the upper water people to seek to catch the largest number of salmon; and he also said, very justly, that the upper water people were the nursers of salmon. Sir Walter Scott, who was an "upper water" man himself, compared them to a hen that hatched a clutch of young ducks, which left the hen when they were able, and took to the deep water, and rarely returned to the parent nest. The upper water people no doubt hatched the brood, but the lower water got the chickens. If things continued as at present, before many years the Irish fisheries would be reduced to the same state as those of England. The value of Irish salmon fisheries now was £300,000 a year, while the value of the English fisheries was £20,000 a year. Mr. Andrews spoke of protection. The reason why the salmon fisheries were kept up so well in Ireland was that they were protected by the upper water people; but that would not continue if the lower water people got the better part of the game. He did agree with Mr. Andrews that salmon should be protected in the upper waters. Mr. Andrews had stated that one of the Commissioners was very much in favour of fixed engines; but he omitted to quote Mr. Ffennell and Mr. Brady, both of whom gave evidence last year before the Parliamentary Committee, showing that there was a decrease of salmon; and the Commissioner referred to by Mr. Andrews had stated in his report for 1862 the very reverse of what was now attributed to him. In 1852 a very able series of articles appeared in the "Dublin University Magazine," which had never been answered. He warned the meeting not to be deceived by the amount of salmon sent last year to the London market; for there were several reasons for that, amongst which was the International Exhibition. Sir Richard De Burgho stated, that if the fixed engines were removed, he had no doubt in the world that there would be an immense increase of salmon; the owners would be in as good a position as they were before, and they would have four times the amount of salmon, instead of seeing a great source of national wealth going to decay.

ALDERMAN JOYNT, of Limerick, said that the honourable member for Waterford had quoted some highly respectable gentlemen in support of the views which he advocated on this subject. Now, whenever an authority was mentioned, it was important to consider the interest of the party in the matter. If he were a gentleman on the upper waters who liked to have a great deal of sport for his own amusement, of course he wished for the annihilation of all fixed engines between him and the sea. That was quite natural, and he would not be a sportsman if he did not entertain the wish. But was that the spirit in which the public and the House of Commons were to discuss a question which came before them on this ground only—how could the largest supply of wholesome food be obtained for the benefit of the public at large? That consideration was the only ground on which legislation on this subject could be justified. The Committee of the House of Commons, which sat last session to consider the question, did not pursue the course best calculated to elicit the truth. They refused to hear the witnesses who were summoned over from Ireland, and who were capable of giving them important information. Just think of people's right under acts of Parliament, and under deeds from the Incumbered Estates Court (which were supposed to give an indefeasible title) being taken away, whilst they were not permitted to be heard in defence of their property. The laws of England on this subject were but eighteen months old, and now the whole of the conservators of the English rivers were calling out that unless the system of Ireland were also adopted, those laws would be a mere farce. People talked about the destruction of salmon. He should like to know what they existed for but to be destroyed and eaten. He was enabled to state that the Shannon and its tributaries were never so crowded with spawning fish as during the season just terminated, and that there never would be such a plentiful season as the ensuing one promised to be: and yet they were told that the salmon was exterminated in Ireland. One of the greatest speculators in the South of Ireland—a gentleman whom he honoured for his high character, the large employment which he gave, and his eminent commercial position—had given £10,000 a few years ago for the salmon fishery of Limerick. That fishery had a weir, which was a stone wall built across the river. Mr. Malcolmson, however anxious he was to abolish stake-nets, did not want to interfere with that weir; it was one of the fixed engines that prescriptive right made sacred. The bill of last session was lost because it was attempted to insert in it a clause that certain rivers should have a forty-feet gap.

MR. BLAKE, M. P.—The forty-feet gap was introduced into the bill.

ALDERMAN JOYNT—Yes, but the bill was not carried.

MR. BLAKE said, the committee put the clause in and tried to carry it, but failed. They would make another effort to carry it next session.

ALDERMAN JOYNT said, it was put in by anglers, who naturally wished to have some fish in the upper waters, but whether the bill was afterwards pressed with the same vigour as before, it was not for him to say. The question was, had the fisheries declined in value? He said they had not, and he would prove it by the official returns. In the year 1852, there were 250 fixed nets; and in 1861, 359, being an increase of 109. The moveable nets used by cotmen had also increased from 741 in 1852, to 967 in 1862; and rods had increased from 1095 to 2012 during the same period. Of course, according to the opponents of fixed engines, there were no salmon to catch, and men continued paying licenses in order to catch nothing. There was also an increase of 2547 in the men employed in the fisheries from 1852 to 1862. The party whom he had the honour to represent on the lower Shannon courted the fullest and most searching inquiry into this subject; and if it were proved that fixed engines were of the injurious character which they had been represented to be, they would at once acquiesce in their abolition.

MR. T. A. PURCELL, Barrister-at-law, said,—that he had listened with the greatest pleasure to the interesting paper read by Mr. Andrews; but his recollection differed in some respects from what had been stated by him. He was under the impression that there was not one stereotyped law as to the rivers of Ireland, but rules which were to be adapted to each of them according to circumstances. He also thought Mr. Andrews in

error in saying that Mr. Barry's opinion differed from that of Mr. Ffennell, and was in favour of the opinion that fixed engines were injurious to the fish.

MR. JAMES REDMOND BARRY, Commissioner of Fisheries, observed, that some of the gentlemen who had referred to him had no knowledge whatever as to what were his opinions on the subject. With the exception of one letter which he had written last summer, he had never publicly given utterance to his opinions on the question, because he did not consider it right for him to do so; but there was one opinion that he would give expression to, and that was, unqualified admiration of the excellent paper read by Mr. Andrews. This contested point was too delicate a question for him to give an opinion upon; but he deeply deplored that the conflict which commenced last summer had caused very great injury to the salmon fisheries of Ireland. There never had been such an extensive system of poaching carried on as during the last year. Those who knew the character of the humbler classes in this country knew that when they saw those above them quarrelling about a matter of property, they were too apt to look upon that property as derelict, and take advantage of it; the result was, that poaching had taken place this year in places where it was never known before. He, therefore, implored the gentlemen who recommenced the contest to do so with temper and moderation, and to take counsel from those sensible men who were animated only by a sense of the public good. He believed the present laws were substantially good, but required some amendment and modification. The great point to insist upon was the protection of the fish in the upper waters; and if that were properly done, he defied the ingenuity of man to destroy the salmon fisheries of Ireland. No doubt there were some objections to bag nets and stake nets, and they ought to be placed under proper restrictions, and those restrictions ought to be properly carried out. There was, however, no doubt that the fish taken in these nets were taken in the very best state.

MR. ANDREWS, in reply to Mr. Blake's observations, stated that his reference to Mr. M'Mahon's bill intended to convey that the parts or clauses to which it was reduced were in relation to queen's gaps, in all weirs, and the abolition of all fixed engines. He was not aware at the time he made allusion to Mr. Barry, Commissioner of Fisheries, that that gentleman was in the room. He (Mr. Andrews) had not given any opinion as to what Mr. Barry's views were; he had merely remarked that with regard to the acts at present in force, Mr. Barry considered that they were judicious and efficient, and in which he fully concurred. On such matters Mr. Barry ought to be a competent judge, as he had been a public officer for more than forty years; and was engaged, in the year 1835, in one of the most important commissions that had been carried out in Ireland. As to what he (Mr. Andrews) quoted with regard to Magna Charta, and to any points of law, they were the statements of a very clever barrister, John Congreve Alcock, Esq., who gave very extensive evidence on legal points in connexion with the fisheries before the Select Committee, in 1849. His successful defence in the case of O'Neill completely overruled the whole of the views of Baron Pennefather.

VIII.—*On the Irish Salmon Fisheries.* By ROBERT WILLIAM CARY REEVES, LL. B., of Trinity College, Cambridge.

[Read February 16, 1863.]

IN preparing a short history of the salmon fisheries of Ireland, I have endeavoured to trace the various improvements established by law during the last twenty years, and to show that by means of these improvements the fisheries have arrived at their present flourishing condition. I shall refer to authentic documents for any facts asserted, and shall thus hope to lay before the Society a truthful and impartial statement.

Before 1836, though there were many reports relating to the Irish deep sea fisheries, we do not find the inland or salmon fisheries alluded to in any of them; but in the report on the British Fisheries, 1825, it is stated that the breed of salmon were decreasing in Ireland, and that this was chiefly due to destruction of fry, and want of preservation of breeding fish. Probably the want of steam communication, and the mode of packing salmon in ice, being little known, only allowed of these valuable fish being sold in the districts where they were caught, and thus made them a drug in the market in some localities, and accounts for the fact of their having been frequently sold for two-pence and three-pence per lb. some thirty years since. To show that this low price was only given in places where there was no means of sending the fish to a better market, I must refer you to the "minutes of evidence taken before the committee on the bill for the more effectual preservation and increase of the breed of salmon, and for regulating the salmon fisheries throughout Great Britain and Ireland," ordered by the House of Commons to be printed 31st May, 1827, pp. 9 and 10. Mr. Henry Goter called in and examined by Mr. Bligh:—"What are you? A London salesman. —What should you consider a fair price for salmon in February? It depends on the supply; it may be 3*s.* 6*d.* or 4*s.* per lb.—You would consider that not an unfair price? No, it is the price generally looked for." The highest price of salmon sold in Billingsgate in February, '62, was 2*s.* 5*d.*, and I have had letters this year stating that it has been as low as 1*s.* 5*d.* On looking then to the reports of the Fishery Commissioners for Ireland for the year 1836, second report, pp. 3 and 4:—"It appears that the Irish salmon fisheries are by no means in a satisfactory condition: as well from the insufficiency of the existing laws as from the systematic breach of their provisions, many rivers highly productive are stated to have become incapable of repaying the outlay of the fishermen." The report, then, in comparing the English and Irish fishery laws, goes on to say—"The same denunciations also are made of artful contrivances to evade the laws for the protection of the breeding fish in their transit to and from the spawning grounds, and of the destruction of fry both voluntarily and by mills and other impediments. Neither in such fisheries is the exact period of close time a matter of major con-

cern: those interested in them naturally abstain from what is injurious to themselves. Whereas the indiscriminate take of salmon is desirable only to the poacher, or to the upper proprietor, who has no marketable share in the proceeds of the river. It is chiefly, therefore, where a rivalry exists between different classes of proprietors, that the proper times of fishing and the use of stake nets and other well-contrived engines for capturing the fish become matter of dispute or litigation." From these statements it seems clear that, at the date of this report, 4th November, 1836, the salmon fisheries of Ireland were not a source of profit either to the proprietors of upper or lower waters. An exception to this appears in the case of the river Foyle, p. 24, where statistics are given of the take of salmon from the year 1808–1823, viz., a period of sixteen years previous to the introduction of stake nets on that river: during this time the average take of salmon in each year was 43 tons. From 1827–1835, when stake nets were in full operation, the average take of salmon was 140 tons; and the year 1835, being the last of the nine years in which stake nets had been in full operation, was the year in which the fourth greatest number of salmon were caught during the nine years. I give you here the tabular form, for each year, copied from the report:—

TABLE No. I.—*Showing the Produce of the Foyle Fishery for Sixteen Years previous to the introduction of the Stake Nets.*

Years.	Number of Salmon.	Weight.			
		Tons.	cwts.	qrs.	lbs.
1808	14,837	87	1	3	13
1809	14,418	86	. .	2	19
1810	17,145	42	17	1	. .
1811	9,601	24	. .	. .	8
1812	19,285	48	4	1	1
1813	14,375	85	18	3	1
1814	18,434	46	1	2	27
1815	20,630	51	11	2	. .
1816	17,624	44	1	. .	24
1817	16,644	41	12	. .	25
1818	17,860	44	18	. .	. .
1819	23,834	58	6	2	22
1820	18,930	47	5	6	. .
1821	11,490	28	14	1	4
1822	22,816	57	. .	3	8
1823	20,384	50	19	. .	26
Gross produce of the sixteen years,	277,802	694	9	3	28

Annual average produce of the Foyle for the sixteen years previous to the introduction of stake nets, 17,363 salmon—43 tons, 8 cwt. 0 qrs. 14 lbs.

Table No. II.—*Showing the Produce of the Foyle Fishery for the last Nine Years, when the Stake Nets were in full operation.*

Years.	Number of Salmon taken in Stake Nets.	Weight taken in Stake Nets.				Number of Salmon taken in Draught Nets.	Weight of Salmon taken in Draught Nets.				Total Produce taken in the Foyle.	Total Weight of Salmon taken in the Foyle.			
		Tons.	cwts.	qrs.	lbs.		Tons.	cwts.	qrs.	lbs.		Tons.	cwts.	qrs.	lbs.
1827	13,911	46	19	1	16	32,090	80	4	2	..	46,001	127	3	3	16
1828	13,070	39	9	..	19	37,536	93	6	3	6	50,606	132	15	3	25
1829	9,770	27	11	1	2	23,000	57	10	..	..	32,770	85	1	1	2
1830	30,957	87	1	..	7	35,096	92	14	3	6	66,053	179	15	3	13
1831	23,267	56	2	1	13	39,293	98	4	2	18	62,560	154	7	..	1
1832	31,497	89	15	..	1	32,950	87	7	2	..	64,447	177	2	2	1
1833	20,757	54	3	2	14	29,580	76	11	3	27	50,337	130	15	2	11
1834	20,575	51	17	1	6	33,173	83	18	1	16	53,748	135	15	2	22
1835	22,344	58	3	3	12½	33,562	85	5	1	28	55,906	143	9	1	10½
Gross Produce of the last Nine Years,	186,148	511		..	0½	296,280	755	4	..	11	482,428	1266	7	..	11½

Annual average produce of the Foyle for the last nine years, since stake nets were introduced, 53,603 salmon—140 tons, 14 cwt. 0 qrs. 14½ lbs.

From this we may fairly argue that during a period of nine years stake nets had on this river been the means of greatly increasing the marketable supply of good fish for the public, without diminishing the stock of breeding fish. This was in the year 1835. Some persons may say that nine years is not long enough to test the system sufficiently; but on looking to the report of 1849, "Lord Donegal's tenants had in Lough Foyle thirty-four stake nets, and the supply of salmon was ample." And, further, in the "Coleraine Chronicle," 5th July, 1862, being a period of thirty-five years from the time when stake nets had been first used, we find it stated—"The take of salmon this week along the coast of the Foyle, in the Bush, and in the Bann, has been enormously large; the number said to have been caught in our river is almost apocryphal. Foyle fish have been selling in Derry all the week at 6*d*. per lb."

It would be impossible to notice, in so short a space, the many reports of the Irish Fishery Commissioners; but it may be sufficient to remark that the utter want of protection given to breeding fish, and the use of lights for spearing salmon at night while spawning, also the number of fry killed by eel-weirs and mill-dams, had reduced the salmon fisheries of this country, which now form so important an item in our exports, to a low ebb; and thus made it absolutely necessary for the legislature to interfere for the purpose of protecting the breeding fish on the upper waters, and defining the rights of proprietors to fish with particular engines on various parts of the stream.

We cannot be surprised that before the passing of the Act of 1842, and other subsequent Acts of Parliament, for the protection of the breeding fish and fry, the fisheries had diminished in value, when we find it stated in the fourth Annual Report of the Commissioners of Public Works *in re* the fisheries of Ireland, 1846, p. 166, Appendix No. II.—"It was formerly quite the fashion to feed the pigs on salmon fry; he has known as many as forty dozen of them to be killed by one boat in a day's fishing." From 1836 to 1842 the salmon fisheries were found to have steadily decreased in value. Before I speak of the Act of 1842, to which I shall just now allude, I should wish to call your attention to the fact that many proprietors of salmon fisheries had a title by Act of Parliament to weirs erected for thirty-one years, before the passing of the Act of 1842; the 6th and 7th of William IV., cap. 180, and 7th William IV., and 1st Victoria, cap. 89, which confirmed their title, were both repealed by the Act of 1842, which gave proprietors a more ample right to erect fixed engines. That the right to erect fixed engines was, prior to the Act of 1842, asserted by many proprietors, and that the Act of 1842 was passed to define those rights and effect a compromise, seems evident from the report of 1836, where it is stated—"The rights of fishing are generally vested in those gentlemen who own estates on either side of the river."

I shall now refer to the Act of 1842, 5th and 6th Vic., c. 106. This Act repealed twenty-six Acts of Parliament relating to Irish fisheries, going back as far as the reign of Edward IV., and in fact established a new code of fishery laws. Having thus alluded to the Act of 1842, I cannot do better than give *verbatim* the words of the 19th section of that Act. It is as follows:—"It shall be lawful for every person who shall hold and occupy as tenant in fee-simple or in fee-tail, or as tenant for life, or as tenant under any lease for a life or lives, or as tenant for a term of years of which not less than fourteen years shall be unexpired at the time of first erecting such net, any land adjoining the sea-shore or any estuary not being within the limits of any such several fishery, but subject to the provisions of this Act, and to such regulations and restrictions as may be made by the Commissioners as aforesaid, to fix or erect such stake net, or other fixed net as aforesaid, attached to that part of the shore adjoining such land. Provided always that no tenant under any lease for a life or lives determinable, or for years of which less than one hundred shall be unexpired, shall be empowered to fix or erect such stake nets or other fixed nets as aforesaid without the previous consent in writing of the chief landlord or lessor seised of any rent and reversion in such lands; and provided also that the placing or erection of such stake nets or other fixed nets as aforesaid shall not give or confer any right or title to the occupancy of the said shore (except for the purpose of attaching the said fixed nets thereto during occupancy of the land as aforesaid)," because on the faith of that section leases of fisheries (fished by fixed engines) have been given, sums of money have been paid for the good-will of the leases, sales of properties with such fisheries attached have been made in the Landed Estates Court, large

sums of money have been invested by capitalists in building ice houses, in establishing rope walks, and generally in placing a large plant on such fisheries. As to these fisheries having been made the subject of settlement, I shall give you cases in point. 1st. As to leases of salmon fisheries fished by fixed engines:—In the year 1848, a gentleman on the lower Shannon gave a lease of two stake weirs for twenty-one years at the rent of £100 per annum; the person who took the lease died, and left a widow and several children; the income derived from this fishery is the only means of support for this poor woman and her family; she is exercising her right under an Act of Parliament, and according to law; and I shall show you, in a later part of this paper, that her vested rights are being assailed by a bill now before parliament. Again, I received a letter a few days since from a person interested in tidal fisheries, who assures me that he paid, early last year, a large sum of money for the interest in the lease of some fisheries on the lower Shannon. Next, as to sales in the Landed Estates Court, the Commissioners of the Incumbered Estates Court (Judges Longfield and Hargreave), by conveyance, dated 24th March, 1852, conveyed to Pelham Joseph Mayne, of Dublin, a fee-simple estate called East Astee, in the county of Kerry, containing 607 acres, 1 rood, 30 perches, which lands are situate on the south shore of the Shannon, about seven miles west of Tarbert; and by said conveyance said Commissioners also conveyed to Mr. Mayne the fishery on said shores (*which had already been described in the printed rental as a valuable salmon fishery*), in the following words:—"The strand and *weir* annexed to and adjoining said lands on the river Shannon, and the fishery on the lands of West Astee, in the barony of Iraghticonnor, and county of Kerry."

In the map attached to the conveyance, the strand on which this fishery was situated is marked, as is also the site of the salmon weir.

I also know a gentleman who invested between two and three hundred pounds, two years ago, in building an ice house and fish house on faith of the Act of 1842, and his materials and plant on his fishery are worth at this moment more than £500.

The Act of 1842, 5 and 6 Vict. c. 106, has been confirmed and amended by half-a-dozen more recent statutes; and from the fact of these fisheries having become the subjects of settlement, nothing short of the clearest proof of a benefit to result from a change in the law should prevail on the legislature to alter the present system; and if they feel themselves coerced to make such a change, the most ample compensation should be provided for all persons who have sunk capital on the faith of the Act of 1842. On looking at the first report of the Fishery Commissioners after the passing of this Act, we cannot, of course, expect any marked improvement, as it is an allowed fact that an increase in the number of salmon from the addition to the spawning fish cannot be tested for three years; but we find it stated in the Report of the Commissioners for 1843, p. 4, the first year after the passing of the Act, 5 and 6 Vict. c. 106. The endeavour, in passing the Act, has evidently been to open the modes of fishing in such manner as to admit of the

greatest supply of fish being obtained by the public, while each should be under such partial restrictions as might tend to the preservation and increase of the breed, and enable all those who could reasonably claim the right to participate in the fishery in a greater degree than they had ever done previously. On turning to the third Report of the Irish Fishery Commissioners, 1845—"Complaints have certainly been made, and dissatisfaction expressed, in some localities; but these may chiefly be attributed to the provisions of the Act not having been clearly understood nor duly enforced; and we feel justified in assuming, on the whole, a decided tendency towards improvement in the commercial value of the Irish fisheries."

This improvement is, no doubt, in some degree attributable to the general spirit and individual enterprise progressing through the country; but the immediate bearing of these agencies upon the fisheries appear to us to be mainly due to the wise provisions of the Act. Again, as to legal stake weirs, bag and fixed nets, p. 9—"The evidence of the productiveness of these modes of fishing clearly establishes the wisdom of the Act which permits their use, and at the same time determines the places for their erection. We do not hesitate to state our conviction that, under the restrictions provided in the Act, the use of these engines adds largely to the gross quantity of good fish taken, and in many instances affords the public a most abundant supply in the spring and early part of the summer, when the fish are most valuable, and in many cases not found in rivers."

Again, in the fourth Report of the Irish Fishery Commissioners, 1846, p. 111, under the head of general observations we find—"Throughout the last year (1845), we have been enabled to trace on the whole the same steady, though slow, progress towards improvement in the general fisheries of the country to which we alluded in our last annual report." At this time it became evident to all persons really interested in the development of the salmon fisheries, that it would be necessary to devise some scheme for better preserving the fish while spawning, as without doing so it would be useless to think of increasing the supply of fish. Voluntary contributions would be small and unavailing, and some plan of compulsory assessment must be devised. We find, accordingly, in the report of the year 1846, p. 10—"Before closing this report, we deem it an essential part of our duty to point out the absolute necessity of establishing a system of assessment for the protection of those fisheries, to be formed on the principles of rating all deriving benefit from them as nearly as possible in proportion of that benefit." To show that voluntary contributions had been tried, and were unavailing, see Sir R. De Burgho's evidence before the Select Committee of 1849; it is as follows:—"That exertions had been made in 1846 to gain funds for the protection of the Shannon in the upper waters, and the sole amount that was enabled to be collected on the whole of the Shannon was £48; it was impossible with this to prevent the destruction by poaching; in fact, of all systems the destruction by poaching was by far the greatest."

In accordance, then, with this wish so generally felt, was passed the

Act of Parliament, 11 and 12 Vic. c. 92. This Act imposed license duties on engines of all kinds, in order to create a fund for the protection of the breeding fish; and it is to the passing of it that we may date the rapid improvement of the Irish salmon fisheries. To illustrate this, when first the Act came into operation, the amount of duty was £2982 15*s.*; and on looking to the fishery report for 1861, we find ihat the amount of license duty was £5125 10*s.* thus showing a great increase since the passing of the Act 11 and 12 Vic. c. 92, in the funds for protecting breeding fish, and without funds for this purpose it is idle to think of increasing the supply of salmon. This increase in license duties paid is not confined to an increase in fixed engines, but extends to rods and moveable engines also. The following form, taken from the reports of the Commissioners, shows the number of licenses paid in the current year 1852 and 1853, and in that of 1860 and 1861.

LICENSE DUTIES RECEIVED IN YEARS 1852 AND 1853.

Number of Salmon Rods,	899
,, Snap Nets,	195
,, Draft ,,	357
,, Bag ,,	163
,, Fly ,,	11
,, Stake ,,	76

LICENSE DUTIES RECEIVED IN YEARS 1860 AND 1861.

Number of Salmon Rods,	1669
,, Snap Nets,	210
,, Draft ,,	484
,, Bag ,,	238
,, Fly ,,	29
,, Stake ,,	81

This return shows an increase in salmon rods of 770, in snap nets of 15, in draft nets of 127, in bag nets of 75, in fly nets of 18, and in stake nets of 5.

In this form I should wish particularly to call your attention to the great addition to the rod licenses; and it may not be out of place to remark *en passant*, that rod fishings are let much higher now than they were formerly. I know of two instances on the Shannon:—one fishery, which till two or three years ago let for £20 a year, now lets for £60; another, which until the lease expired, in 1859, let for £40 a year, now lets for £120. I now must refer you to the report of the Fishery Commissioners for Ireland, for 1857, p. 7:—

"The principle of the present laws has now been sufficiently tested as suitable to the object in view, namely, the proper government of the salmon fisheries, to elicit the approval of the country generally, but an opinion, unanimous it may be said, has for some time been entertained by those interested in the fisheries, as well as by the magistracy, who are

so often called upon to adjudicate upon offences, that it would be highly expedient to consolidate the six existing Acts, to render them simple, and by some amendment in details, to remove doubts as to their interpretation, where some obscurity in language may exist. The Commissioners, concurring in this view, recommended in their two last reports to Parliament that this should be done, and they received instructions from the executive government to prepare a bill for this object. This has been complied with by the solicitor of the Board embodying the six Acts into one, after which certain corrections in detail have been suggested for consideration, and have been approved; and a copy of the consolidated bill is now ready to be submitted to the government when instructions shall be received to that effect." And the public may fairly ask why the bill alluded to in that report, and which is printed, and based on the experience of the Fishery Commissioners for the last twenty years, should not be introduced (if it is necessary to introduce any Bill for the improvement of the Salmon Fisheries), instead of that brought forward by Mr. M'Mahon this session, as the former would be brought forward officially by persons who ought to understand from their great experience how to deal with so important a subject, while the latter is a measure which, if passed, will merely have the effect of transferring the salmon fisheries of Ireland from one class of proprietors to another, and is framed in defiance of the last twenty years' experience, and must have the effect of placing the salmon fisheries much in the same state as they were before 1842. And here it is important to notice that the observations made by Sir R. Peel, in his speech on Wednesday last, fully concur in the statement given by Mr. Ffennell last year,—that though before the Act of 1842 the salmon fisheries were at a very low ebb, they have been improving ever since; and that the upper parts of the river never equalled the lower in value. And he further observes, it is a well-known fact, that salmon, after leaving the salt water, gradually deteriorates in quality, until it again returns to the sea.

It may not be out of place to explain how the rights of different proprietors would be affected by Mr. M'Mahon's bill, and to cite the second section of it which is as follows:—

"2. No fixed engine of any description shall be placed or used for catching salmon or trout, in any inland or tidal waters; and any engine placed or used in contravention of this section may be taken possession of or destroyed; and any engine so placed or used, and any salmon taken by such engine, shall be forfeited; and in addition thereto, the owner of an engine placed or used in contravention of this section shall, for each day of so placing or using the same, incur a penalty not exceeding ten pounds; and for the purposes of this section, a net that is secured by anchors, or otherwise fixed to the soil or made stationary in any other way, shall be deemed to be a fixed engine. But this section shall not affect any ancient right or mode of fishing of any person by virtue of any grant or charter."

First, then, tracing the river from its source, first come the rod fishermen; next come the owners of the great weirs held under charter at the

junction of the fresh and salt water; next to them come the draft net fishermen; and further down come the owners of stake and bag nets; the rod fishermen are to be left in *statu quo*. The great weirs at the junction of the fresh and salt water are to be left with this restriction, that where no queen's gap exists, one is to be made, and where it does exist, it is to be extended, but in no case to exceed forty feet (the queen's gap is the open left in the weir to give some of the fish a chance of escape). The draft net fishermen are not to be restricted, but the fixed nets are to be annihilated. That such a measure is unjust, I have attempted to show; that such a measure is impolitic, I can show from the fact that more than half the funds for protecting the upper water is supplied by fixed engines; and I think it has been clearly shown that without funds to protect the breeding fish, any measure will be useless. Again, another of the arguments used by the advocates of Mr. M'Mahon's bill is this, that a much greater number of poor fishermen would be employed if fixed engines were abolished. A greater number of poor draft net fishermen might be employed; but all the fishermen connected with fixed engines would be ruined, as where fixed engines are now in use no movable net, from the nature of the shore and strength of tides, could be used. This is a fact admitted on all sides; and that these men would become a burden to the country, is shown from the fact that the guardians of the unions of Kilrush, Glin, and Kildysart, for the reasons I have given, petitioned against Mr. M'Mahon's bill last year.

Another of the arguments brought forward by the promoters of this bill is the necessity of assimilating the English and Irish fishery laws. To show how little any analogy exists in this respect between the two countries, I must refer you to the report of the Fishery Commissioners for 1857, p. 7:—"The climate of the greater part of the Continent denies the luxury of salmon to the inhabitants. The natural characters of much of the fresh waters in England and elsewhere are unproductive, from the sluggish nature of their discharge; so that Ireland and Scotland, with the advantages which nature provides in rapid gravelly streams where alone fructification can occur, must always stand unrivalled in this part of the world in the production of this valuable food; and hence the special claims which both countries possess upon the legislature for its best consideration of the laws applying to a question of such importance." Again, I hold in my hand a return from the firm of Messrs. Forbes, Stuart, and Co., the eminent London factors, by which it appears that the number of boxes of salmon (containing about 112 lbs. each), sold in London from Ireland since 1834 amounts to 114,942, while the number from England, in the same period, amounts to 3,149. I could also show, if time permitted, that in many English rivers, where stake and bag nets never existed, the salmon have become almost extinct; and, above all, there is this strong distinction between the English and Irish fishery laws, that no Act, creating vested rights like that of 1842, was ever passed for the English fisheries.

I have thus endeavoured to point out how valueless the salmon fisheries were before the year 1842; how by means of the Act of 1842, and

the Acts which confirmed and amended it (particularly that for imposing license duties), the fisheries rapidly improved in a commercial point of view, and now afford the public a large supply of good food taken in the parts of rivers and in estuaries where salmon are in the highest condition; while the great increase in the number of rod licenses shows that they also afford increased sport to the angler. And here I would remark that, if in any river it is found that a fair proportion of fish do not go up to the upper waters (when I say a fair proportion, I do not mean an equal number, because it is impossible for anglers to supply the market, and while it is only just that all proprietors should have a fair share, still the tidal waters will always be the places in which salmon are in best condition for the market, and thus most valuable as an article of commerce) in the cases above referred to, the close season ought to be extended. This was done last year on the Shannon (when the fishing season was shortened from 12th August to 6th July, for fixed engines, while the rod fishing goes on till September), and has been found to work most satisfactorily by allowing a greater number of breeding fish to go up. So great has been the quantity of breeding fish this year in the Shannon, that in some places the same spawning-ground has been disturbed three or four times by successive sets of breeding fish. If we consider the fact that a female salmon produces 1,000 ova to the pound, and that the average weight of spring salmon is over 14 lb. in most rivers, it seems evident that if breeding fish are allowed to go up in sufficient quantities, and then protected when on the spawning grounds, an ample supply of fish for everybody must be the result.

I have also attempted to point out how advisable it appeared to the Commissioners to consolidate the existing laws, and how the bill to be introduced by Mr. M'Mahon would attempt to violate vested rights, and that there are no advantageous reasons for assimilating the English and Irish fishery laws. In conclusion, I would remark that, before any legislation takes place, there ought to be a full, fair, and impartial inquiry; for Mr. M'Mahon's bill (if passed) will ruin numbers who, trusting in an Act of Parliament, have invested their capital, and have, consequently, acquired valuable properties—

> "The which
> To leave is a thousandfold more bitter than
> 'Tis sweet at first to acquire."

MR. JOHN KNIGHT BOSWELL stated that he had been requested by an absent gentleman, Mr. Ffennell, who was formerly a Commissioner of Fisheries in Ireland, but who now held that position in England, to vindicate him from imputations which had been made against him in the discussions on this subject.

The Chairman (MR. JOHN LOCKE) interrupted him by stating that no imputations had been cast upon Mr. Ffennell, and that therefore it was unnecessary for Mr. Boswell to proceed.

MR. BOSWELL then read several extracts from a pamphlet by Mr. Ffennell, entitled, "Remarks on Past and Present Legislation for the Protection of the Salmon Fisheries of

Ireland; and concluded by saying that, with respect to his own opinion, while he agreed with Mr. Ffennell in opinion that fixed engines along the coast were the greatest possible destruction to the salmon fisheries, he could not think that any public body should deprive men of vested rights without compensation. It was well known that salmon went into fresh water to spawn. Then they retired into the deep seas to recruit themselves, migrating towards the northern countries of Europe, and on returning hugged the shores in order to find their own rivers. If they were then all caught in fixed engines placed round headlands, the proprietors in the upper waters, where the fish were bred and protected, had a right to complain.

Mr. Theobald A. Purcell wished to make a few observations. He was not interested in either view of the question. The point of view in which it had been presented by Mr. Reeves to-night was that of vested rights. He had heard an interesting discussion at the last meeting on the same subject, and the view then presented was that the public interests, and those only, should be considered in any discussion on the subject. There were two distinct questions involved: one—What was best for the interests of the public? and the other, whether those who had vested rights were entitled to compensation? It was important, of course, to those who had invested capital, on the faith of legislation and existing Acts of Parliament, that their rights should be fairly dealt with; but that was really not the principal question in relation to the introduction of a general measure concerning the interests of the public at large, which was—the best means of supplying an abundance of cheap salmon. He had seen statements in "The Daily Express," made by Mr. Joynt; and, as an inquirer after truth, he would wish Mr. Reeves to remove some difficulties which appeared to him in reading these returns, and comparing them with Mr. Reeves' statements. Taking Mr. Joynt's and Mr. Reeves' statements together, he found that in the four years from 1855 to 1858, compared with the four years ending 1862, there was a decrease of 1000 boxes of salmon sent to the London market in the latter period, although there was a large increase in the number of fixed engines. It was a curious coincidence that, with the increase of the number of fixed engines, there was a corresponding decrease in the quantity of salmon sent to the London market. In the five years from 1853 to 1857, compared with the five from 1858 to 1862, the decrease in the quantity of salmon sent to the Liverpool market in the latter period was 1271. He found from Mr. Joynt's returns, also, that from 1839 to 1842, when fixed engines became legal, 15,324 boxes of salmon were sent to the London market; while from 1849 to 1852 the number had diminished to 14,266 boxes. In the period from 1853 to 1856, compared with that from 1857 to 1860, there was a deficiency in the number of boxes sent to the London market of 3143. These were striking facts. From 1842 to 1847—from the time fixed engines had been established down to the year immediately preceding the establishment of conservancy—there were 28,551 boxes sent to the London market; while in the period from 1848 to 1853 there were only 23,691, showing a decrease of 4860 boxes. This required explanation; for he contended that these very returns established that a decrease in the amount of salmon had synchronized with the increase in the number of fixed engines. Mr. Reeves had dwelt upon the importance of vested interests; but he seemed to forget that nothing was more common than for men to spend large sums in the acquisition of interests which were doubtful. This was verified by his own experience. Men would pay on chance for fisheries, although they had no warranty for calculating that the interests they purchased would be permanent. It appeared to him that those who opposed the bill were inconsistent. They cried, away with monopoly, and consider only the public interest. He willingly joined in the cry to do away with the vested interests of those who had any interests in the upper waters; but he did not see why the same rule should not be applied to the owners of stake nets in the lower waters, provided these changes were required for the public advantage.

Sir Patrick O'Brien, Bart., M. P., said that in his opinion any legislation on this subject should be a compromise. Compensation for interference or abolition of vested rights was wholly out of the question. He concurred that when the bill of Mr. M'Mahon was in committee, care should be taken to make such arrangements by the widening of queen's gaps, or otherwise, as would admit the fish to the upper waters, whilst preserv-

ing, as far as was compatible with the interests of the public, the rights of the proprietors of fixed engines. Both parties interested should give and take.

MR. JAMES REDMOND BARRY, Fishery Commissioner, said he could endorse every statement contained in the valuable paper read by Mr. Reeves. Reference had been made to the Act of the 5th and 6th of Victoria, with the administration of which he had been connected for many years. In the recent debate in the House of Commons on this subject, an honourable member described that Act as having been disgracefully forced through the house, and characterized it as an Irish job. The fact was that it had been most carefully considered by a Select Committee, composed of the following gentlemen:—Lord Elliot (chairman), Mr. Jackson (afterwards Judge Jackson), Sir R. Ferguson, Colonel Conolly, Sir Edmund Hayes, Captain Jones, Richard Lalor Shiel, Daniel O'Connell, Maurice O'Connell, Sir William Somerville, Lord Clements, Mr. John Young, and Sir Matthew Wood. He asked was it likely that such men would treat lightly and carelessly a question of great importance which had been entrusted to them for consideration? This Committee sat on the 3rd May, 1842, and continued its sittings for a long time, and examined several witnesses, and brought up an amended bill on the 5th July, which received the royal assent on the 10th of August; and that is the much-abused Act 5th and 6th Victoria, cap. 106. He bitterly deplored that the sentiments expressed by the hon. member who had last addressed them did not universally prevail; for if they did, the cause of peace, the interests of all classes concerned, and the prosperity of the fisheries would be promoted. Sir Robert Peel threw out a suggestion to that effect during the late debate, but he regretted to find that it was met by the hon. member who introduced the bill by an insulting cry of "No surrender."

MR. ANDREWS said that when he visited the Shannon in 1831 salmon were selling at Glyn, near Tarbert, at 2*d.* per lb. The present facilities of transit did not then exist. When lately visiting the Shannon, he traced that there was no diminution in the take of salmon whenever the season was suitable to the fishing, although stake nets had considerably increased. Mr. Boswell's views with regard to the migration of the salmon were very erroneous, and were the ideas in the time of Buffon. Salmon did not retreat far from the estuaries or parts of the coast where the rivers to which they were peculiar emptied. Frequent changes were necessary to them—from the fresh water to the salt, and their return to the rivers again. The important points were to secure the protection of the breeding fish in the upper waters by proper suppressions of the extensive poachings that too generally prevailed throughout the rivers of Ireland. At present the stake-net proprietors contributed the largest proportion of funds to the furtherance of protection. In his (Mr. Andrews') opinion no satisfactory conclusions to any party could be secured by compromise, especially when a member, in the late debate in the House of Commons, stated that there were 320 claimants to be disposed of. With reference to Mr. Purcell's statement he would say that the returns of salmon sent through various channels to the English markets were not obtained as complete as might be expected.

MR. JAMES HAUGHTON said that the cardinal point of the whole discussion, viz., the difference in the interests of the proprietors of the tidal waters and the upper waters, had been hit upon by Mr. Boswell. Until these differences were satisfactorily arranged, it was impossible that the question could be set at rest.

CAPTAIN BRABAZON thought the proprietors of the upper waters would not be satisfied unless something were done to protect their interests. The bag nets at headlands he believed to be most destructive, as they would capture nearly all the salmon in their course to the rivers in which they spawn. Some years ago a gentleman named Nixon had a valuable fishery in the county of Mayo; but Sir Richard O'Donnel having let the fishery at Achill Head for a small sum, in the following summer scarcely a salmon came to Mr. Nixon's river, whilst they were caught in immense numbers at Achill by bag nets. After the passing of the Act of 1842, a bag net fishery was established at Clogher Head, giving a return of £300 a year, by which the fishery in the River Boyne was deteriorated to that amount. He believed the proprietors of the upper waters would take very little interest in the protection of the breeding fish if they were not allowed to derive some advantage from it.

MR. RANDALL M'DONNELL referred to the speech of Mr. Purcell. The course which he adopted was to select short periods of four years each, and from such to deduce as to the diminution of salmon. In his opinion this course was open to objection; for the occurrence of one bad year, or dry season, in such period, would materially affect the numbers of the period. He thought it most material that, in questions of this kind, public interests should be chiefly consulted. But Acts of Parliament should be to a certain degree permanent, and not altered in a short time unless after mature deliberation.

MR. PURCELL explained that the periods he selected were taken with reference to the establishment of fixed engines.

MR. BARRY again rose to say that he had obtained and now submitted a return, for the accuracy of which he pledged himself, showing the amount of salmon sent to the London markets between the years 1834 and 1862, inclusive, which would show conclusively that the exportation of salmon from Ireland, instead of diminishing, was increasing, and that the largest number ever exported was in the year 1862, when it amounted to 7841 boxes:—

BOXES OF SALMON, 112 LBS. EACH.						
	Scotch.	Irish.	Dutch.	Norwegian.	Welsh.	Total.
1834	30,650	350	[No account kept.]	[No account kept.]	[No account kept.]	31,000
1835	42,330	470				42,800
1836	24,570	430				25,000
1837	32,300	400				32,700
1838	21,400	900				22,300
1839	16,340	2500				18,840
1840	15,160	4574				19,734
1841	28,500	3760				32,260
1842	39,417	4490				43,907
1843	30,300	4644	595	103	40	35,682
1844	28,178	4248	269	269	. .	32,964
1845	31,062	3803	913	215	46	36,039
1846	25,510	5214	849	100	41	31,714
1847	20,112	6052	330	74	72	26,640
1848	22,525	4373	1148	67	48	28,161
1849	23,690	4388	692	. .	50	28,820
1850	13,940	2135	105	54	72	16,306
1851	11,593	4141	203	212	40	16,189
1852	13,044	3602	176	306	20	17,148
1853	19,485	5052	401	1208	20	26,166
1854	23,194	6333	345	. .	128	30,000
1855	18,197	4101	227	. .	59	22,584
1856	15,438	6568	68	5	200	22,279
1857	18,654	4904	622	. .	220	24,400
1858	21,564	6429	973	19	499	29,484
1859	15,630	4855	922	. .	260	21,667
1860	15,870	3803	849	40	438	21,000
1861	12,337	4582	849	60	442	18,506
1862	22,796	7841	568	87	454	31,746

MR. REEVES then briefly replied, contending that all the returns had conclusively shown that the Irish salmon fisheries had improved, instead of, as had been alleged, deteriorated.

IX.—*On the Mineral Localities of Donegal, as ascertained by Sir Charles Gièsecke, and by the British Association Committee,* 1861–2. By ROBERT H. SCOTT, M. A.

[Read on Monday Evening, November 17, 1862.]

THE information contained in the two published accounts of the tours undertaken by Sir Charles Gièsecke, in the county of Donegal, in the course of the years 1826 and 1827, at the expense of the Royal Dublin Society, is not as accessible to the members as it might be—only one of them being published in the Proceedings for 1827. I have therefore extracted from them, and from the manuscript catalogue of Mr. Donald Stewart's specimens, all the matter which is valuable to the mineralogist. To this I have added the results of the explorations carried out in the course of the last two seasons.

I have appended to the notice of each locality the name of the discoverer of the mineral at that locality, as far as I was able to ascertain it. The names of Messrs. Gregg and Lettsom are given as authority for localities given in their "Manual of Mineralogy," which I cannot otherwise identify. I regret to say that much reliance cannot be placed on these localities, as they have not been personally identified by the authors of the work abovenamed (see under *Analcime* and *Gypsum*.)

All localities which have been identified by the British Association Committee, in the progress of their investigations, are marked with an asterisk.

It is much to be regretted that the name of R. Townsend, Esq., C. E., does not appear more frequently. This gentleman spent some years in Donegal, having been stationed at Glenties during the years 1847–8, and collected a great number of minerals. He, unfortunately, rarely attached labels to his specimens, which have therefore been lying, hitherto undescribed (Dec., 1862), in various collections in this city, since the year 1850. I am, however, indebted to the kindness of J. V. Stewart, Esq., D. L. of Rockhill, Letterkenny, for a great number of localities, specimens from which are in his collection. I am informed by Mr. Stewart that most of these localities were verified by Mr. Townsend, who named many of the specimens in the collection. Mr. Stewart's name is given as authority for these localities.

In the Table, at the end, the localities are given under the heads of the different parishes, so that any of them may be at once found by reference to the six-inch Ordnance Maps of the county.

CATALOGUE.

SIMPLE ELEMENTS.

Graphite. Found in rolled pieces on the shore of Sheephaven, near Ards House (Sir C. Gièsecke); in the Burndale, Convoy (J. V. Stewart, Esq.). Has not been found *in situ*.

SULPHURETS, ETC.

Galena. Has been worked in several localities, the chief of which are Kildrum; Marfagh; Ards; Fintown; Drumnacross; Kilrean; Mullantiboyle; Welchtown; Malinbeg; Abbey Lands and Abbey Island, Ballyshannon; Ballymagrorty; Finner; Tonregee; Glentogher, Carndonagh; Castlegrove, Letterkenny. (Griffith's "Mining Localities of Ireland."—Journ. Geol. Soc. Dub., vol. ix., p. 143.)

Molybdenite. In hexagonal plates with actynolite, disseminated through elvan at Lough Laragh,* near Glenties (R. H. Scott); at Lough Anure (J. V. Stewart, Esq.).

Note.—Molybdenite also occurs in the oligoclase veins at Garvary,* near Castle-Caldwell, two miles from the county of Donegal (Rev. S. Haughton).

Blende. Occurs with galena at several of the localities mentioned for that species, especially Kilrean* and Fintown.

Copper Pyrites. Not very common; occurs crystallized at Kildrum (Sir C. Gièsecke).

Iron Pyrites. Cubes of iron pyrites are abundant in the mica slate and accompanying rocks, in various parts of the county, particularly near Killybegs* and at Culdaff,* and Malin. At Crohy Head* large crystals occur in the soapstone.

Magnetic Pyrites. Occurs in detached crystals in the metamorphic rocks about the Barnesmore Mountains, and at Leaghtown; at Doorin Rock (W. Harte, Esq.). The variety found at Barnesmore contains traces of nickel and cobalt.

Fluor Spar. Occurs in the limestone near Donegal; the variety is phosphorescent (W. Harte, Esq.); at "the Pullans" (R. Mallet, Esq.); at Rathmullen (J. V. Stewart, Esq.).

OXIDES (METALLIC.)

Rutile. Prisms of this species occur in quartz pebbles in the Rive Dale (Sir C. Gièsecke), and in mica slate in Arranmore (Sir C Gièsecke); at Malinbeg, large prisms in quartz (Gregg and Lettsom); at Ards (J. V. Stewart, Esq.).

Sapphire. A few rolled crystals were brought from the county of Donegal by R. Townsend, Esq., and given by him to Professor Apjohn. Precise locality not known.

Magnetic Iron. Octahédral crystals occur in the syenite at Horn Head,* and throughout the Dunfanaghy district. Also in serpentine at Aghadoey* (Rev. S. Haughton and R. H. Scott), and in anthophyllite at Crohy Head.*

Ilmenite. Plates of this species, called rutile by Sir C. Gièsecke, occur in quartz at Woodland Dooish, near Stranorlar (W. Harte, Esq.); and at Edergole, near Corabber bridge, Lough Eask (W. Harte, Esq.); at Breaghy Head.

Specular Iron. At Glenkeeragh and Fox Hall (J. V. Stewart, Esq.).

Micaceous Iron. Near Malin,* and at Croaghonagh Quarry,* Lough Mourne.

Red Hæmatite. At Innishkeel (Sir C. Gièsecke); pseudomorphous in cubes, replacing iron pyrites, at Woodland Dooish, near Stranorlar (W. Harte, Esq.).

Brown Hæmatite. At Malinbeg in a lode.

Bog iron ore—Very abundant throughout the mica slate district of the county.

Psilomelane. Impure psilomelane occurs in Arranmore (Sir C. Gièsecke), and in the Slieve League district.

OXIDES OF SILICON, ETC.

Quartz. *Rock Crystals.*—Leabgarrow,* Arranmore Island (very fine); Slieve League.

Rose Quartz.—Bradlieve Mountain, near Ballintra (W. Harte, Esq.); in veins in granite, Pollakeeran Hill, near Lough Mourne (W. Harte, Esq.); Maghery (J. V. Stewart, Esq.).

Amethyst.—In veins in granite, at the Waterfall in Barnes River,* half a mile above Barnes Lough, and on Edergole Mountain.

Smoke Quartz.—Very fine crystals, with graphic granite in a vein; Brown's Hill,* Barnesmore Mountains (W. Harte, Esq.); Slieve League (R. J. Montgomery, Esq.); Barnesbeg Gap (J. V. Stewart, Esq.); Knockastoller (J. V. Stewart, Esq.).

Chalcedony. In rolled pieces at St. Peter's Lough, Mountcharles; in amygdaloidal trap at Doorin Rock* (Sir C. Gièsecke); Cloghan (Gregg and Lettsom); Ards (J. V. Stewart, Esq.) Very abundant in micaceous conglomerate, in the baronies of Raphoe and Innishowen.

Opal. At Mountcharles (Sir C. Gièsecke).

Siliceous Sand. In great abundance, and extremely pure on top of Muckish Mountain.

Lydian Stone.—Common in the Carboniferous Limestone between Donegal and Ballyshannon.

ANHYDROUS SILICATES.

ANDALUSITE SECTION.

Andalusite. In mica slate, at Clooney Lough,* near Narin (W. Harte, Esq.); on Scalp Mountain, four miles W. N. W. of Muff (Gregg and Lettsom); at Barnesbeg Gap (J. V. Stewart, Esq.).

Chiastolite. Barnesbeg Gap (J. V. Stewart, Esq.).

Kyanite. In mica slate, with garnets, schorl, and sphene, in the reef of rock which runs from Fin M'Coul's Pan, Ballykillowen,* to Lough Derg (W. Harte, Esq.); at Altnapaste; near Doochary Bridge (Sir C. Gièsecke).

Fibrolite. In gneiss, in several localities, where that rock occurs in the granite (R. H. Scott,), Croaghnamaddy,* near Dungloe; Lough Anure,* at the north end; Annagary Hill,* behind the pound. The best crystals are at Lough Anure.

Beryl. In quartz veins and in granite, at Sheskinarone,* one mile north of Dungloe, on the road to Annagary (Analysis, Q. J. G. S., vol. xviii., p. 417.)

Beryl occurs also, disseminated through the granite, at the same locality, in a subcrystalline condition, forming beryl granite.

Tourmaline. *Schorl* is very abundant in the gneiss in the neighbourhood of Ballyshannon and Donegal, especially about Ballintra,* and at Knader (J. V. Stewart, Esq.); with garnets and kyanite at Ballykillowen* and Golard,* near Donegal (W. Harte, Esq.); in garnet rock at Aghadoey* (R. H. Scott); in granite, at Annagary;* at Cloghan; at Kilmadoo, parish of Clondehorkey; and at Glinsk, in Fanad (J. V. Stewart, Esq.).

Indicolite.—Some dark-coloured prismatic crystals, from the county of Donegal, occurring in granite, and labelled Augite, proved to be indicolite on examination by Dr. Aquilla Smith.

Sphene. Very abundant in granite throughout the county, especially in the white granite of Narin* (Rev. S. Haughton), and Aphort,* Arranmore (R. H. Scott).

In gneiss, with kyanite, schorl, and garnets, at Ballykillowen* (W. Harte, Esq.).

In a peculiar rock, consisting of orthoclase, green pyroxene, and quartz (sphene rock), which occurs in contact with the highly crystalline limestone of the granitic district of the country (R. H. Scott).

It is most abundant at Annagary,* where there are two types of sphene rock—one containing small crystals of sphene, with dark green prisms of pyroxene; the other containing sphene in larger crystals, and in much greater abundance, and in it the pyroxene is of a light green colour, and less distinctly crystallized. Also at Barnesbeg* Gap, near Kilmacrenan, where large nests of sphene are found; in Glenleheen*; and in the neighbourhood of Lough Nambradden,* near Fintown; at Cloghercor, parish of Innishkeel; and at Tirlyn, near Creeshlagh (J. V. Stewart, Esq.).

AUGITE SECTION.

Pyroxene. Two varieties, coloured light and dark green, occur with orthoclase and quartz, forming sphene rock, at most of the localities where limestone is found in the granite, *e. g.* Annagary,* Glenleheen,* and Barnesbeg* (Rev. S. Haughton and R. H. Scott); Knockastoller and Derryloaghan (J. V. Stewart, Esq.).

Sahlite.—Occurs in quartz at Lough Nambradden, near Fintown (Sir C. Gièsecke); at Glenties (J. V. Stewart, Esq.).

Augite.—In prisms, imbedded in greenstone, at Tory Island (Sir C. Gièsecke).

Tremolite. Abundant in crystalline limestone, with idocrase and garnet, especially at Annagary* and Bunbeg.*

Anthophyllite. At Finmore (W. Harte, Esq.); the Craigs, Raphoe (Rev. S. Haughton); Crohy Head,* in the cliff, 200 yards from the eastern extremity of Aghnish Lough (R. H. Scott); at the mill near Gartan Abbey,* close to the soapstone.

Actynolite. In elvan, with molybdenite, at Lough Laragh, near Glenties* (R. H. Scott); at Gartan and Drumsallagh (J. V. Stewart, Esq.).

Asbestiform Actynolite.—At Tirlyn; Aghalative, near Ards; Glenaboghill; and Fintown (J. V. Stewart, Esq.).

Hornblende. Abundant in syenite throughout the county, especially at Loughrosmore (W. Harte, Esq.); Horn Head;* at the Black Gap* (Rev. S. Haughton), and in the townland of Golard* (W. Harte, Esq.); Lough Anure (J. V. Stewart, Esq.).

Hornblende Rock.—Is found at Kilrean,* near Ardara; Raneany Bridge,* near Laghy (W. Harte, Esq.)

Asbestus. At Kilrean, near Ardara;* at Crohy Head; at Rathmullen (J. V. Stewart, Esq.); in potstone, at Laght, parish of Donaghmore (J. V. Stewart, Esq.).

Chondrodite. In crystalline dolomite near the Guidore (Gregg and Lettsom).

GARNET SECTION.

Garnet. Occurs disseminated through gneiss and mica schist in the S. E. part of the county, especially at Golard* and Ballykillowen,* parish of Templecarne (W. Harte, Esq); at Aghadoey,* it occurs in the gneiss in such quantities as to form garnet rock (Rev. S. Haughton). Clear varieties occur in granite at Shallogan Bridge, and on the south-side of the Guibarra valley; in the Poison Glen; at Tirlyn and Killoughcarran, near Creeshlagh (J. V. Stewart, Esq.); and in limestone at Aphort, Arranmore.*

Opaque varieties occur, with hair-brown idocrase, epidote, and tremolite, in crystalline limestone in many places, *e. g.*, Glenleheen;* Derryloaghan; Toberkeen,* near Dungloe; Annagary;* Lough Anure;* Bunbeg;* Barnesbeg Gap,* near Kilmacrenan; Tirlyn.

At Toberkeen, loose crystals, many of them pitted and worn by the action of the sea-water, are found on the beach. They are frequently two inches or more in diameter.

Cinnamon-stone.—At Trawenagh Bar (Sir C. Gièsecke).

Grossular.—At Annagary;* at Bunbeg (J. V. Stewart, Esq.).

Idocrase. The bacillar variety occurs in limestone at most of the localities above-mentioned for opaque garnets; also at Madavagh, near Lettermacaward (J. V. Stewart, Esq.). On the promontory, at the north end of Lough Anure,* it is found in four-sided crystals (R. H. Scott); also at Toberkeen.

Epidote. Occurs pretty commonly, with garnet and idocrase, in the altered limestone. At Drumnaha, Glenleheen,* it is found well crystallized; at Aphort,* Arranmore, in great abundance, in gneiss, close to the limestone (R. H. Scott); at Pollnacally;* Crohy, in a vein in syenite (R. H. Scott); at Woodquarter, parish of Mevagh (J. V. Stewart, Esq.); at Muckamish and Rathmullen, parish of Killygarvan (J. V. Stewart, Esq.); at Lough Laragh, near Glenties (W. Harte, Esq.).

Scapolite. In sphene rock at the Cross Roads, in Glenleheen* (R. H. Scott); at Tirlyn (J. V. Stewart, Esq.).

Note.—This mineral was discovered at Holy Hill, Strabane, by Sir C. Giesecke, in 1828; and Dr. W. Frazer has drawn my attention to the fact that it had been previously discovered at Killala, county of Mayo, by the late Archdeacon Verschoyle.

FELDSPAR SECTION.

Orthoclase. Of a pinkish colour, very abundant in gneiss along the southern edge of the granite, about Lough Errig* and Glenleheen;* at Lough Barra; also in veins in the granite at other localities, especially at Pollnacally,* and near Lettermacaward; at Breaghy Head; white in Glenveagh;* at Knockastoller (J. V. Stewart, Esq.); and at Knader, near Ballyshannon (J. V. Stewart, Esq.); crystallized specimens occur with the beryls at Sheaskin na Rone,* and also in the neighbourhood of Lough Nambraddan,* near Fintown.

In a quartz vein, with chlorite and micaceous iron, at Croaghonagh* Quarry, near Lough Mourne (Analysis, Q. J. G. S., vol. xviii. p. 411).

Oligoclase. Abundant in granite, accompanying orthoclase, throughout the county, especially at Annagary;* in gneiss at Glen,* near Creeshlagh* (Rev. S. Haughton); in syenite, at Black Gap,* near Pettigo, and at Ballykillowen* (Analysis, Q. J. G. S., vol. xviii., p. 412).

Note.—The veins of greenish oligoclase and black mica containing molybdenite and copper pyrites, which were discovered by the Rev. S. Haughton (Anal., *l. c.*), occur at Garvary Wood, near Castle-Caldwell, county of Fermanagh, about two miles from the border of the county Donegal.

Labradorite. Opalescent feldspar, supposed to be labradorite, occurs in boulders of granite in the Guibarra valley, and along the shore of the Rosses (Sir C. Giesecke).

Aventurine feldspar.—Was found by Sir C. Giesecke in the Doochary district.

Pitchstone. Dykes of this rock, some of which are amygdaloidal, penetrate the granite of Barnesmore,* and are also found in other parts of the county.

Felstone. Felstone porphyry occurs in a columnar dyke in granite between Tordhu and Cladaghillie, in Arranmore* (R. H. Scott).

MICA SECTION.

White Mica. This occurs in considerable quantities in the granite, together with black mica. It is common at Sheaskin na Roan,* near Dungloe, with the beryls; also at Ballaghgeeha Gap,* Dooish Mountain (Rev. S. Haughton); in gneiss (speckled) at Breesy Mountain* (W. Harte, Esq.); at Madavagh, near Lettermacaward (J. V. Stewart, Esq.).

The presence of this mineral in the granite is further marked by the predominance of orthoclase over oligoclase. There is hardly a trace of it to be found at Garvary in the oligoclase vein.

Black Mica. This occurs in small plates throughout the whole area of the granite, and also in the gneiss on its flanks, especially at Glen,* near Creeshlagh. It is also found in nests in the granite, as is the case at Newry; also in syenite and hornblende rock, but sparingly, Kilrean,* near Ardara.

Large crystals are found in quartz at Annagary* (Rev. S. Haughton); also at Ballaghgeeha Gap,* Dooish Mountain (Rev. S. Haughton), and at Doochary Bridge.

Green mica.—Produced by weathering from the foregoing, is found in a remarkable granite vein which penetrates the gneiss near the Black Gap;* also radiated, on quartz, near Rockhill (J. V. Stewart, Esq.).

Chlorite. In quartz at Malin;* with orthoclase and quartz at Lough Mourne* (W. Harte, Esq.); at Killybegs;* Ards (J. V. Stewart, Esq.).

HYDROUS SILICATES.

TALC SECTION.

Talc. At Crohy Head,* crystallized, with iron pyrites (Donald Stewart); Foxhall (Sir C. Gièsecke); Glenkeeragh.

Soapstone. At Crohy Head* (Donald Stewart); at the mill, near Gartan Abbey;* at Ards.

Potstone. Called "Cambstone" in the neighbourhood, at Convoy;* at Laght, parish of Donaghmore (J. V. Stewart, Esq.); near Killygordon (W. Harte, Esq.); at Culdaff.*

Serpentine. *Common Serpentine*, with magnetic iron, occurs at Aghadoey,* near Donegal (W. Harte, Esq.), close to the garnet rock; at Rossnakill,* in Fanad (Rev. S. Haughton and R. H. Scott); near Dunfanaghy (Gregg and Lettsom).

Noble serpentine.—Occurs near Drumbo (Sir C. Gièsecke).
Verde antique marble.—Occurs at Crohy Head,* near the coast-guard station (Mr. Walker).

ZEOLITE SECTION.

Natrolite. In the cavities of the amygdaloidal trap dyke called Doorin Rock,* near Mountcharles (Sir C. Gièsecke); also in Barnesmore Mountain,* in pitchstone dykes; in trap dykes at Lough Barra, and in the Poison Glen (J. V. Stewart, Esq.).
Analcime. In opaque crystals, with garnet and idocrase, near the Guidore (Gregg and Lettsom). [?]

CARBONATES, SULPHATES, ETC.

Calcite. At Cloghan; in the neighbourhood of Donegal, at Lacken and Laghy quarries (phosphorescent when heated) (W. Harte, Esq.).

Black.—At Rathmullen and Culdaff.*
Pink.—At Ards; at the Reelan Bridge (J. V. Stewart, Esq.).

Arragonite. In limestone at "the Pullans," near Brown Hall (R. (Mallet, Esq.).
Marble, *white* (statuary marble) at several localities, especially Dunlewy;* Marble Hill;* Glenveagh;* Dunfanaghy;* Croaghanarget,* parish of Killymard.

Pink.—At Ards (J. V. Stewart, Esq.); at Muckish Mountain (Sir C. Gièsecke).

Sparry Iron. At Glentogher, Innishowen (Sir C. Gièsecke); at Tircallan, near Stranorlar (J. V. Stewart, Esq.).
Calamine. Near Ballyshannon (Sir C. Gièsecke.)
Lead, Carbonate of. At Keeldrum mine (J. V. Stewart, Esq.).
Heavy Spar. Occurs as a gangue at Fintown.*
Gypsum. A quantity of fibrous gypsum is lying at Woodhill, Ardara, which is said to have been found by Major Nesbit, the late owner, on the property, about thirty years ago: no person is able to give any information about it. The locality given by Gregg and Lettsom, viz., Ballintemple Glen, parish of Errigal, appears to be incorrect, as Errigal parish is situated on the borders of the counties of Londonderry and Antrim, at a distance of 30 miles from the county of Donegal.
Pyromorphite. At Keeldrum mine (Sir C. Gièsecke).
Apatite. In brownish-black mica near Annagary (Sir C. Gièsecke); in sphene rock at Barnesbeg [?] (R. H. Scott).

The following Table gives the different localities and the minerals to be found at each, under the heads of the respective baronies and parishes.

Parish.	Locality or Townland.	No. of Ord. Sheet.	Minerals.
INNISHOWEN.			
CULDAFF, . . .	Culdaff, ...	5	Iron pyrites, potstone, black calc spar.
"	Glentogher, ...	11	Galena, sparry iron ore.
CLONCA, . . .	Malin, ...	4	Iron pyrites, micaceous iron, chlorite in quartz.
FAHAN, . . .	Scalp Mountain, ...	88	Andalusite.
RAPHOE.			
CONVOY, . . .	Convoy, ...	69	Potstone, graphite (in the Burndale).
"	River Dale, ...	69	Rutile.
CONWALL, . .	Castlegrove, ...	53	Galena.
"	Glenkeeragh & Fox Hall,	52	Specular iron, talc.
DONAGHMORE, .	Croaghonagh, ...	77	Micaceous iron, chlorite, red feld-spar.
"	Laght, ...	79	Potstone, asbestus.
"	Killygordon, ...	78	Potstone.
KILTEEVOGUE, .	Welchtown, ...	68	Galena.
"	Cloghan, ...	68	Chalcedony, schorl, calc spar.
"	Altnapaste, ...	77	Kyanite.
RAPHOE, . . .	The Craigs, ...	61	Anthophyllite rock.
STRANORLAR, .	Woodland Dooish, . . .	78	Ilmenite, red hæmatite replacing pyrites.
"	Pollakeeran Hill, . . .	86	Rose quartz.
"	Brown's Hill, ...	85	Smoke quartz, in graphic granite.
"	Drumbo, ...	78	Noble serpentine.
"	Tircallan, ...	78	Sparry iron.
LECK, ...	Rockhill, ...	61	Green mica, pink marble.
KILMACRENAN.			
CLONDAHORKY,	Ards, ...	26	Graphite (on sea-shore), rutile, chalcedony, chlorite, pink calc spar, soapstone.
"	Aghalative, ...	26	Actynolite.
"	Breaghy Head, ...	16	Ilmenite, orthoclase.
"	Horn Head, ...	15	Magnetic iron, hornblende, galena (in Marfagh).
"	Tirlyn, ...	35	Actynolite, garnet, almandine, idocrase, scapolite, sphene.
"	Killoughcarran, ...	35	Almandine.
"	Kilmadoo, ...	15	Schorl.
CLONDEVADDOCK,	Glinsk, ...	17	Schorl.
"	Rossnakill, ...	17	Serpentine.

Parish.	Locality or Townland.	No. of Ord. Sheet.	Minerals.
KILMACRENAN, (*continued*).			
GARTAN, . . .	At the mill near the Abbey, ...	44	Anthophyllite, soapstone.
"	Drumsallagh, ...	51	Actynolite.
"	Glen Veagh, ...	43	White orthose, white marble.
"	Poison Glen and Ballaghgeeha Gap, . .	43	Black and white mica, natrolite in trap dykes.
"	Lough Barra, ...	51	Red orthoclase, natrolite in trap dykes.
KILLYGARVAN, .	Rathmullen, ...	37	Fluor, asbestus, epidote, black calc spar.
"	Muckamish, ...	37	Epidote.
KILMACRENAN, .	Barnesbeg Gap, ...	35	Smoke quartz, andalusite, sphene, pyroxene, garnet, idocrase, epidote, apatite (?).
MEVAGH, . .	Woodquarter, ...	27	Epidote.
"	Glen, ...	26	Oligoclase and black mica in gneiss.
TULLAGHOBEGLY,	Keeldrum, ...	33	Galena, pyromorphite, white lead ore, copper pyrites.
"	Bunbeg, ...	32	Tremolite, garnet, idocrase, grossular.
"	Dunlewy, ...	42	Precious garnet, marble.
"	Knockastoller, ...	32	Smoke quartz, pyroxene, sahlite, orthose.
"	Muckish Mountain, . . .	25	Siliceous sand, red marble.
BOYLAGH.			
INNISHKEEL, .	Kilrean, ...	74	Galena, blende, hornblende rock, and asbestus.
"	Drumnacross and Mullantiboyle, ...	74	Galena.
"	Lough Laragh, ...	74	Molybdenite and actynolite in elvan, epidote.
"	Innishkeel, ...	64	Red hæmatite.
"	Loughill, Loughrosmore,	78	Hornblende.
"	Clooney Lough, ...	64	Andalusite.
"	Narin, ...	64	Sphene in granite.
"	Clogbercor, ...	66	Sphene, schorl.
"	Derryloaghan, ...	65	Pyroxene, garnet, idocrase.
"	Glenties, ...	74	Sahlite.
"	Glenaboghill, ...	64	Actynolite.
"	Board of Works' Road, between Shallogan Bridge and Doochary Bridge, ...	58 66	Almandine in granite, orthoclase, black mica.

Parish.	Locality or Townland.	No of Ord. Sheet.	Minerals.
BOYLAGH, (*continued*).			
INNISHKEEL, . .	Glenleheen (cross-roads),	58	Sphene, pyroxene, garnet, idocrase, epidote, scapolite.
"	Drumnaha, ...	58	Garnet and epidote.
"	Lough Errig, ...	66	Red orthoclase.
"	Lough Nambradden, .	66	Sphene, sahlite, crystallized orthoclase.
"	Fintown, ...	66	Galena, blende, heavy spar, actynolite (asbestiform) in limestone.
"			
TEMPLECRONE,	Maghery, ...	56	Rose quartz, fibrolite.
"	Croaghnamaddy, . . .	57	Fibrolite.
"	Toberkeen, ...	49	Garnet, idocrase, tremolite.
"	Croby Head, ...	56	Rock crystal, talc, soapstone, verde antique marble, iron pyrites, anthophyllite rock, asbestus, magnetic iron.
"	Pollnacally, ...	56	Epidote, red orthoclase.
"	Sheaskin na Rone, . .	49	Beryl, crystallized orthoclase, white mica, garnets, rose quartz.
"	Annagary, ...	41	Sphene, pyroxene, tremolite, garnet, idocrase, epidote, schorl, fibrolite, oligoclase in granite, black mica, apatite, hornblende.
"	Lough Anure, ...	41	Molybdenite, fibrolite, garnet, idocrase, tremolite.
"	Arranmore Island, . .	48	Manganese, pipe-clay at Illion, rock crystals (very fine) at Leabgarrow, sphene in granite, garnets and epidote in gneiss at Aphort.
LETTERMACAWARD, . . .	Madavagh, ...	65	Idocrase, white mica.
"	Trawenagh Bar, . . .	65	Garnet (cinnamon stone).
BANAGH.			
GLENCOLUMBKILLE, . . .	Malinbeg, ...	89	Galena, rutile, brown hæmatite (at the White Strand).
"	Slieve League, ...	96	Iron pyrites, manganese, rock crystals, smoke quartz.
KILLYBEGS, . .	Killybegs, ...	97	Iron pyrites in mica slate, chlorite.
"	Ardara, ...	83	Hornblende rock.
KILLYMARD, .	Croaghanarget, . . .	75	White marble.

Parish.	Locality or Townland.	No. of Ord. Sheet.	Minerals.
BANAGH, (*continued*).			
Inver, ...	Mount Charles, ...	98	At St. Peter's Lough, chalcedony and opal.
"	Doorin Rock, ...	99	Natrolite and opal in trap, magnetic pyrites.
TIRHUGH.			
Donegal, . . .	Edergole and Tawnawully Mountains, .	85	Amethyst veins in granite, amygdaloidal pitch-stone, ilmenite.
Drumhome, . .	The Pullans, ...	104	Fluor, arragonite.
"	Laghy, ...	100	Calc spar, fluor, Lydian stone in limestone.
"	Raneany Bridge, . . .	100	Hornblende rock.
"	Golard, ...	100	Schorl, garnet, sphene, hornblende rock.
"	Ballykillowen, ...	100	Kyanite, schorl, sphene, garnet, in mica slate.
"	Finmore, ...	95	Anthophyllite rock.
"	Aghadoey, ...	104	Magnetic iron, serpentine, garnet rock, schorl.
"	Bradlieve Mountain, .	104	Rose quartz.
"	Ballintra, ...	103	Schorl.
Templecarne,	Black Gap, ...	105	Hornblende and oligoclase, green mica.
Kilbarron, .	Abbeylands, Tonregee, Finner, ...	107	Galena and calamine.
"	Ballymagroarty, . . .	103	Galena.
"	Knader, ...	107	Schorl, orthose.
"	Breesy Mountain, . . .	108	White mica, speckled.

In addition to the minerals mentioned in the foregoing Catalogue, I have received the names of a few other species; but consider that it is better to omit them altogether than to mention them on insufficient authority. I have received permission to adopt this course from the gentleman who furnished me with the information.

X.—*Wood Spirit and its Detection*. By EMERSON J. REYNOLDS.

[Read Thursday Evening, January 22, 1868.]

THE products of the destructive distillation of various vegetable matters, in addition to those of primitive organic origin, have received more than ordinary attention and careful study at the hands of the chemist within the last ten or twelve years. Numerous highly complex acids, neutral substances, and bases, have rewarded the time and labour expended on their investigation, by the acquirement of both fame and riches for the discoverer—fame owing to the great scientific value of the results, and riches in consequence of their practical application. The number and complexity of the compounds formed during the destructive process cease to surprise us, when we consider the ever-changing circumstances under which they are produced. To take an instance intimately connected with the subject of the present paper; let us suppose a block of wood placed in a close cylinder, and submitted to a gradually increasing temperature. The essential constituents of this block are carbon, hydrogen, oxygen, and nitrogen, all in different states of combination both on the surface and in the interior of the mass. On the first application of heat, the strictly organic structures are broken up superficially, their elements entering into new combinations, in which state they are volatilized. On the still further increase of temperature, the next succeeding layers undergo a similar process; but now, owing to the alteration of temperature, and probably in consequence of the different proportions and arrangements of the proximate constituents, another set of affinities come into play: the result of this is, as might be anticipated, the production of many new compounds, materially different from those preceding them. Thus the process continues, the products altering in character as the temperature fluctuates. Such being the case, it ceases to be a matter of wonder that the compounds formed should be both numerous and variable, or that the examination of these should open an almost inexhaustible field of research to the scientific explorer.

My object in laying the present communication before the Society is to bring forward a new and reliable test for the detection of pyroxilic spirit, and likewise to give a brief preliminary notice of some experimental results which I have obtained in the course of an investigation undertaken with a view to the complete separation of the more volatile constituents of wood naphtha.

As pyroxilic spirit in its purest commercial form has been the subject of most of my experiments, it may be interesting to describe briefly the process by which it is manufactured on the large scale.

When wood is distilled in close vessels, and at high temperatures, it yields a variety of products, which may be classed under three heads—solid, liquid, and gaseous. The solid and gaseous products, not being connected with our present subject, may be dismissed without further

comment, our attention being solely confined to the liquid portions. The tarry mixture which is the result of the first operation is rectified, and the more volatile portions redistilled from lime or chalk, by which means the acetic acid, which is present in large quantity in the crude liquor, is gotten rid of. The distillate then constitutes the rough wood naphtha of commerce. When required for medicinal use, this is further purified as follows:—The crude material is largely diluted with water, by which means the oily hydrocarbons always present are precipitated, the last trace of these being afterwards removed by the action of oxidizing agents. The very weak methylic spirit thus produced is then frequently rectified *per se*, and finally over quick lime until the specific gravity is reduced to about 800. It then constitutes medicinal naphtha.

The spirituous liquid thus produced is far from pure, since it consists of a mixture of acetate of methyl, acetone, methylic alcohol, and other bodies, which have been as yet but very imperfectly examined. Were we to attempt to separate these impurities by fractional distillation alone, failure could only attend our efforts, as a comparison of the boiling points of the three bodies already mentioned will show.

Acetate of methyl	boils at	133° F.
Acetone ,,	,,	133° F.
Methylic alcohol	,,	149° F.

The separation of methylic alcohol can be easily effected by means of chloride of calcium, but other methods must be adopted for the purpose of investigating the remaining constituents of the spirit.

When studying the deportment of various metallic salts with the purified naphtha, I observed the following reaction:—When a little solution of chloride of mercury was mixed with a few drops of the spirit, and then excess of potash added, the oxide of mercury first thrown down was speedily redissolved with the production of a clear solution. This result can be obtained in the cold, but is more rapidly brought about by the aid of a gentle heat. When acetic acid was added to the alkaline solution a yellowish-white gelatinous precipitate was formed, but slightly soluble in dilute acetic, nitric, or sulphuric acids, though readily dissolved by hydrochloric, which appeared at the same time to decompose it. The deportment of this precipitate, on the application of heat, when taken in connexion with other considerations hereafter to be mentioned, necessarily led me to conclude that I had obtained a definite compound of mercury with one of the constituents of pyroxilic spirit.

A considerable quantity of the naphtha was now submitted to careful distillation, and the portions which came over up to and at 176° F. were collected. After remaining steady at this temperature for some time, the boiling point rapidly rose to 182° F., and this distillate was likewise collected apart from the rest. On testing the two portions with chloride of mercury and potash, as before described, the first distillate gave the reaction very strongly, and the second not at all. The more volatile liquid was now rectified repeatedly from lime, and afterwards saturated

with chloride of calcium. The impurities were then distilled off with the aid of a water-bath; and the liquid which collected in the receiver, when tested as before, exhibited the reaction remarkably well. The results of these experiments indicate, in the first instance, that pure methylic alcohol is not connected with the production of the mercurial compound; and, secondly, that the body whose presence is essential to the resolution of the oxide of mercury has a low boiling point.

From this time I commenced the investigation of the mercurial compound, and have since succeeded in tracing it to its origin, and making out its history to some extent, as well as its more important chemical relations. As this is matter not essentially connected with the practical application of the test, I will reserve it for the subject of a future communication, merely stating here, that *acetone* is principally concerned in the production of the reaction already described.

I will now give the results of some experiments with the mercurial solution above referred to, which may serve to illustrate its more distinctive characters: I will then pass on to the description of a method for the detection of "methylated spirits."

Experiments with Mercurial Solution.—A portion of the liquid was evaporated *in vacuo;* after a few days, it had solidified to a firm, opaque jelly; after a little time longer, crystals commenced to sprout out from the edges, and continued increasing daily, until what was formerly a jelly had become covered with beautifully formed acicular crystals, many of the delicate reed-like tufts reaching far above the edges of the capsule, and growing, as it were, out of a resinoid amorphous mass. Analysis proved that these crystals consisted merely of chloride of potassium, the difference in crystalline form from that usually observed being due, as is well known, to the modifying influence of organic matter. The gummy residue remaining in the capsule after separating the crystals was then examined with a microscope, and found to be totally destitute of crystalline structure, the detached pieces being smooth and rounded, very brittle, and semi-transparent. When heated to a temperature of about 450° F., it swelled up considerably, at the same time evolving a quantity of mercurial and empyreumatic vapour, and leaving a voluminous residue of carbon. When the original solution was boiled violently, a white gelatinous precipitate was formed, readily soluble in dilute hydrochloric acid, though apparently but slightly acted on by dilute acetic, nitric, or sulphuric acids.

Excess of acetic acid was now added to another portion of the alkaline solution, and the resulting precipitate thoroughly washed, and then transferred to a retort; some hydrochloric acid was now added, and the mixture distilled. The distillate, when tested with chloride of mercury and potash in the usual manner, gave the reaction very strongly. Some solution of chloride of mercury and a few drops of the naphtha were mixed, and then excess of potash added, which caused the resolution of the oxide of mercury without the aid of heat. A portion of this solution,

on the cautious addition of an acid, did not give any precipitate. The mixture was now gently warmed, and afterwards acetic acid added, upon which a precipitate was immediately formed.

From the results of these experiments, the following information may be gleaned:—1st. That the compound in question is somewhat resinoid in character, and destitute of crystalline structure; 2ndly. It is precipitated by boiling, or on the addition of an acid; 3rdly. It is easily decomposed by hydrochloric acid, the organic body passing off apparently unchanged; and 4thly. It is always necessary to employ heat previous to the addition of an acid, otherwise no precipitate will be produced immediately. A consideration of the first of these points, viz., the want of crystalline structure, the gelatinous appearance, and, in fact, the *colloidal* nature of the compound in question, led me to resort to the beautiful principle of "dialysis," as a means of freeing its solution from all saline impurities. In order to put this idea to the test of experiment, some of the mercurial solution was placed on a dialyser, floating on a considerable bulk of distilled water. After twenty-four hours, the diffusate contained a large quantity of chlorine, and but a very small proportion of mercury. The diffusion was then allowed to continue for eight days, during which time the water was changed twice a day. On the ninth day, a mere trace of chlorine could be detected in the diffusate, and but little mercury. The liquid on the dialyser was almost odourless, and colourless, and of high specific gravity; it was neutral to test papers, and gave a copious precipitate both on boiling and the addition of acetic acid, thus demonstrating that the original compound was still present in the solution, apparently unchanged.

In my subsequent experiments I have found this method of separation most valuable, since it enables me to easily purify the colloidal mercurial compound from the crystalloids which accompany it in solution. The recapitulation of these my earliest experiments is sufficient to show the more important relations of this peculiar compound, and likewise enables me to point out how this particular reaction may be made available for the detection of "methylated spirits."

Detection of Wood Spirit.—It is a well-known fact that the liquid sold under the name of "methylated spirits" is a mixture of ten per cent. wood naptha, and ninety of spirit of wine. The addition of the former communicates a very disagreeable taste and odour to the latter, thus rendering it unpotable, and, it is said, unfit for internal use. This mixed spirit, though easily recognised by its odour when alone, yet if used in the preparation of many strong-smelling tinctures or essences, cannot be thus detected, and we are then obliged to resort to chemical means to aid us in the discovery of the adulteration. Up to the present time, but one test has been proposed for the detection of wood spirit; this is generally known as "Ure's test," having been first mentioned by the eminent chemist of that name. This test simply consists in adding powdered hydrate of potash to the suspected liquid; if wood spirit be pre-

sent, the mixture becomes brown in about half an hour. That this is a simple, easy, and correct test when the spirit is unmixed with vegetable principles, I do not deny; but there is one serious source of error, which, I think, prevents it from being generally applicable to the detection of wood spirit in alcoholic tinctures, and this I will now endeavour to make evident. In commencing the examination of a sample of any tincture, it is, of course, necessary to distil it, and apply the test to the distillate. We all know that most tinctures contain some volatile principles extracted from the plants used in their preparation; when these are distilled, the volatile oil, though generally of a high boiling point, is dissolved in the vapour of the spirit, and thus contaminates even the first portions of the distillate. If to this we add caustic potash in powder, in many cases the liquid will assume a brown tint, even though wood spirit is not present, owing to the well-known action of the alkali on many essential oils—thus indicating an adulteration which did not really exist.

The method which I adopt in testing for wood spirit is as follows:—A small quantity of the suspected spirit is placed in a tube retort, and distilled over into a cooled test tube; two or three drops of a very dilute solution of chloride of mercury are now added to the distillate, and then excess of solution of caustic potash, and the whole well shaken. If the precipitated oxide of mercury does not redissolve even on warming the liquid, wood spirit is not present; should complete solution be effected, however, the mixture is warmed, and divided into two portions; to one acetic acid is added, which causes the formation of a yellowish-white bulky precipitate; the remaining portion is boiled, and a similar precipitate is thrown down, thus proving with certainty that wood naphtha is present. In applying this test, it is necessary to be careful not to add too much of the mercurial solution, as in that case an insoluble compound would be formed, and, as a consequence, a negative result arrived at.* When practised as I have now described, I look upon this test as being safe and reliable; at least, so far as my experience with it goes, I have always found its indications to be correct, and not liable to the ambiguity occasionally occurring with the potash test. I make this statement not on merely theoretical grounds, but from information gleaned in the course of a series of comparative experiments with pure tinctures, and those purposely adulterated with wood spirit. I trust that this reaction may prove useful as a means for the detection of an adulteration, which, I am sorry to say, numerous analyses have shown me is practised to some extent in this city.†

---

* It must not be forgotten that oxide of mercury is soluble to a slight extent in potash; but such a solution would not yield a precipitate on boiling, or on the addition of an acid.

† I may mention that "cleaned spirit" is capable of reacting with the mercurial salt in a manner precisely similar to the ordinary "methylated spirit."

XI.—*Note on Pure Methylic Alcohol.* By EMERSON J. REYNOLDS.

[Read Thursday Evening, January 22, 1863.]

A SOMEWHAT lengthy discussion has recently been carried on in the pages of some chemical and pharmaceutical periodicals, relative to the best method of "cleaning" or rendering inodorous the ordinary "methylated spirits," in the course of which it has been suggested that in all probability perfectly pure methylic alcohol is as free from all disagreeable odour as the ordinary spirits of wine, even though the chemical text books state the contrary. As, in the course of some experiments, it became necessary for me to prepare some perfectly pure methylic alcohol, it may not be uninteresting at the present time if I state briefly my experiences with it.

The source from which I proposed to obtain the pure alcohol was the oxalate of methyl. This salt was prepared as follows:—

The purified naphtha was distilled as long as the boiling point remained steady at 176° F. Equal weights of the distillate, oxalic, and sulphuric acids were now rapidly distilled, and the resulting oxalate crystallized from the liquid which collected in the receiver. The ether was then dissolved in alcohol and again crystallized; the product from the last operation was then rectified from oxide of lead, and finally twice recrystallized from alcohol. The resulting pure oxalate of methyl was then decomposed into oxalic acid and methylic alcohol, by two different modes of treatment; 1st. By the action of hydrate of potash in excess, and subsequent distillation; 2ndly. By the prolonged action of water alone in a close vessel, and employing a moderate temperature, this product was likewise distilled; the reaction which takes place in each instance being according to the following equations:—

$$\text{(1.)}\quad \left.\begin{matrix}(C_4O_4)''\\(C_2H_3)_2\end{matrix}\right\}O_4+2\left.\begin{matrix}K\\H\end{matrix}\right\}O_2=\left.\begin{matrix}(C_4O_4)''\\K_2\end{matrix}\right\}O_4+2\left.\begin{matrix}C_2H_3\\H\end{matrix}\right\}O_2.$$

$$\text{(2.)}\quad \left.\begin{matrix}(C_4O_4)''\\(C_2H_3)_2\end{matrix}\right\}O_4+4HO=\left.\begin{matrix}(C_4O_4)''\\H_2\end{matrix}\right\}O_4+2\left.\begin{matrix}C_2H_3\\H\end{matrix}\right\}O_2.$$

The dilute methylic alcohol thus obtained was then rectified from lime, and both specimens found to possess the following properties:— As thus prepared, it is a mobile inflammable liquid of low boiling point, having a distinct and peculiar, though not disagreeable odour, quite different from that of ordinary alcohol, and a burning taste. No compound is formed with oxide of mercury soluble in potash. Finally, when treated with powdered hydrate of potash, and allowed to remain in contact with it for twenty-four hours, the mixture had not become in the least coloured, proving, as I think, that the action of Ure's test for pyroxilic spirit depends on the presence of one or other of the impurities usually existing in wood naphtha, and not on any power which the alkali possesses of decomposing the methylic alcohol itself.

XII.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

El Observatorio de Marina de la Ciudad de San Fernando.
Almanaque Náutico para el año 1864, calculado de Orden de S. M. en el Observatorio de Marina de la Ciudad de S. Fernando.
8vo. *Cadiz*, 1862

The Author.
Anderson (William, Esq.). The Re-Construction of the Malahide Viaduct. 8vo. *Dublin*, 1862

The Author.
Barry (J., M. D.). Registration of Births, Marriages, and Deaths in Ireland . . . 8vo. *Dublin*, 1862

The Author.
Blacker (Rev. Beaver H., M. A., . . .). Address . . . at the . . . Booterstown Young Men's Christian Association . . . . 14 Jan., 1863. 8vo. *Dublin*, 1863

The Trustees of the Melbourne Public Library, Victoria.
Catalogue of the Melbourne Public Library for 1861.
8vo. [*Melbourne*, 1862]

Catalogue of the Victorian Exhibition, 1861. With . . . Essays . . .
8vo. *Melbourne*, 1861

Richard Langford, Esq.
Cecil. The Homestead, . . . Reflections on America and Ireland, ... 8vo. *London*, 1862

The Author, Lieut. P. H. Colomb, R. N.
Colomb's Patent Flashing Night Signals. 8vo. *Devonport*, 1862

The Author, Mr. Eugene Musson.
Creole of Louisiana. Letter to Napoleon III., on Slavery in the Southern States. Translated from the French.
8vo. *London*, 1862

The Author.
Crory (William Glenny, . . .). Industry in Ireland. . . . Agricultural . . ., Manufacturing . . ., and Commercial Advantages of Ireland. 8vo. *Dublin*, 1863

Herman R. de Ricci, M. D.
Devincenzi (G., Member of the Italian Parliament, ...). On the Cultivation of Cotton in Italy. Report of the Minister of Agriculture, Industry, and Commerce . . . of Italy. 8vo. *London*, 1862

The Editor.
Dublin Quarterly Journal of Science: . . . . . . Edited by the Rev. Samuel Haughton, M. D., F. R. S. Nos. VIII., IX.

THE AUTHOR.

Geoghegan (Thomas G., M. D., F. R. C. S. I., ...). Clinical Study, its Means and Method: a Lecture delivered . . . . . November 6, 1862. 8vo. *Dublin*, 1862

THE SECRETARY OF STATE FOR WAR, BY COLONEL SIR HENRY JAMES, R. E., . . .

James (Colonel Sir Henry, R. E., . .). Abstracts from the Meteorological Observations taken in the Year 1860–1. . . . 4to. *London*, 1862

THE BRITISH ARCHÆOLOGICAL ASSOCIATION.

Journal of the British Archæological Association . . . . December 31, 1862. 8vo. *London*, 1862

THE JABLONOWSKI SOCIETY, LEIPZIG.

Laspeyres (Etienne, Dr. Jur. et Phil., ...). Geschiste der volkswirthschaftlichen Anschauungen der Niederländer und ihrer Litteratur zur Zeit der Republik. . . . . Gekrönte Preisschrift. 8vo. *Leipzig*, 1863

THE AUTHOR.

Mallet (Robert, C. E., F. R. S.). Appendix to the Account of the Earthquake-wave Experiment made at Holyhead. 4to.

THE GOVERNOR-GENERAL OF INDIA IN COUNCIL, BY THOMAS OLDHAM, LL. D.

Memoirs of the Geological Survey of India. Palæontologia Indica. . . . . The Fossil Flora of the Rajmahal Series, . . .
Part 1, Series 2, by Thomas Oldham, . . . and John Morris, . . . 4to. *Calcutta*, 1862

Memoirs of the Geological Survey of India. . . . Vol. IV., Part 1. 4to. *Calcutta*, 1862

THE ROYAL SOCIETY OF STRASBOURG.

Memoires de la Société des Sciences Naturelles de Strasbourg. Tome Cinquième, 2e et 3e Livraisons. 4to. *Paris et Strasbourg*, 1862

THE AUTHOR.

Moore (William, M. D., T. C. D., . .). The Study of Medicine: . . . Lecture delivered . . . Nov. 1, 1862. 8vo. *Dublin*, 1862

THE NATIONAL ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.

National Association for the Promotion of Social Science. The Transportation of Criminals, . . . Edited by J. B. *Fowler*, and Martin *Ware*, Jun., Secretaries. 8vo. *London*, 1863

THE AMERICAN PHILOSOPHICAL SOCIETY.

Proceedings of the American Philosophical Society. Vol. IX. January, 1862. No. 67. 8vo. *Philadelphia*, 1862

THE BOSTON SOCIETY OF NATURAL HISTORY.

Proceedings of the Boston Society of Natural History. Vol. VIII. 1861 to 1862. 8vo. *Boston*, 1862

JAMES HAUGHTON, ESQ., M. R. D. S.

Proceedings of the International Temperance and Prohibition Convention, ... in London . . . . 1862. Edited by the Rev. J. C. *Street*, Dr. F. R. *Lees*, and Rev. D. *Burns*.

DE LE PART DE L'AUTEUR.

Regnault (M. V., . . .) Relation des Expériences . . . . pour déterminer les lois et . . . . nécessaires au calcul des Machines au feu. Tome second. 4to. *Paris*, 1862

THE NEW YORK STATE LIBRARY, ALBANY.

Report (Fifty-fourth Annual) of the Trustees of the New York State Library. 8vo. *Albany*, 1862

THOMAS OLDHAM, LL. D.

. . . *Report* of the Geological Survey of India, and of the Museum of Geology for the Year 1861–2. 8vo. *Calcutta*, 1862

THE GOVERNORS OF THE RICHMOND DISTRICT LUNATIC ASYLUM.

Richmond District Lunatic Asylum, Dublin. Report . . . for the Year 1862. 8vo. *Dublin*, 1863

THE SECRETARY OF STATE FOR INDIA, IN COUNCIL.

Rig-Veda-Sanhita, ... with the Commentary of Sayanacharya. Edited by Max Müller, M. A., ... Vol. IV. 4to. *London*, 1862

THE ROYAL INSTITUTION OF GREAT BRITAIN.

Royal Institution of Great Britain. Notices of the Proceedings. Part XII. 1861–2. 8vo. *London*, 1862

Royal Institution of GreatBritain, . . . List of Members, Officers, and Professors in 1862. . . . Report of Visitors for the Year 1861. 8vo. *London*, 1862

From ———.

St. Stephen's-green. Correspondence with respect to the Opening of St. Stephen's-green. 8vo. *Dublin*, 1862

THE UNIVERSITY OF KIEL.

Schriften der Universitat zu *Kiel* aus dem Jahre 1861. Band VIII. 4to. *Kiel*, 1862

THE AMERICAN PHILOSOPHICAL SOCIETY.

Transactions of the American Philosophical Society, . . . Vol. XII. New Series. Part II. 4to. *Philadelphia*, 1862

THE HISTORIC SOCIETY OF LANCASHIRE AND CHESHIRE.

Transactions of the Historic Society of Lancashire and Cheshire. New Series. Vol. II. Session 1861–62. 8vo. *Liverpool*, 1862

THE BOTANICAL SOCIETY OF EDINBURGH.

Transactions of the Botanical Society. Vol. VII., Part II. 8vo. *Edinburgh*, 1862

THE INSTITUTION OF CIVIL ENGINEERS, IRELAND.
Transactions of the Institution of Civil Engineers, Ireland. 27th Session, 1861–2. Vol. VII., Part 1. 8vo. *Dublin*, 1862

THE LITERARY AND HISTORICAL SOCIETY OF QUEBEC.
Transactions of the Literary and Historical Society of Quebec. Vol. V. Part 1. May, 1862. *Quebec*, 1862

THE NATIONAL ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.
Transactions of the National Association for the Promotion of Social Science, ... 1862. Edited by George W. *Hastings*, LL. B. 8vo. *London*, 1863

THE PATHOLOGICAL SOCIETY OF LONDON.
Transactions of the Pathological Society of London. Volume XIII. . . . . . 8vo. *London*, 1862

THE ROYAL SCOTTISH SOCIETY OF ARTS.
Transactions of the Royal Scottish Society of Arts. Vol. VI. Part 2. 8vo. *Edinburgh*, 1862

THE ROYAL BAVARIAN ACADEMY OF SCIENCES, MUNICH.
Transactions. Sitzungsberichte der Königl. bayer. Academie der Wissenschaften zu Munchen. 1862. II. Heft 2. 8vo. *Munchen*, 1862

THE GERMAN GEOLOGICAL SOCIETY, BERLIN.
Transactions. Zeitschrift der Deutschen geologischen Gesellschaft. XIV. Band. Heft. 2, 3. 8vo. *Berlin*, 1822

THE PUBLISHER.
Unity of System. 12mo. *London*, 1862

J. FORBES WATSON, A. M., M. D., ...
Watson (J. Forbes, A. M., M. D., ...), International Exhibition, 1862. India. Classified and Descriptive Catalogue. 8vo. [*London*, 1862]

THE ROYAL IRISH ACADEMY.
Wilde (W. R , Vice-President of the Royal Irish Academy). Descriptive Catalogue of the Antiquities of Gold in the Museum of the Royal Irish Academy. . . . . 8vo. *Dublin*, 1862

Wilde (W. R., M. D., ...) Descriptive Catalogue of the Antiquities of Animal Materials and Bronze in the Museum of the Royal Irish Academy. . . . . 8vo. *Dublin*, 1861

THE EDITOR.
Year Book of Agricultural Facts . . . . for 1862. Edited by Robert Scott *Burn*. 8vo. *Edinburgh and London*, 1863

(Signed) EDW. RICHARDS PUREFOY COLLES,
Librarian.

March 31, 1863.

BOTANIC GARDEN.

John Locke, Esq., M. R. D. S., who received from J. T. Bagot, Esq., *Adelaide, Australia*;—Parcel of Seeds collected on Stuart's exploring expedition.

Miss Ireland, *Merrion, Booterstown*:—Parcel of Seeds from the north of India.

Lady Llewellyn, through Mrs. Portlock, *Lota, Blackrock*:—Parcel of Seeds of *Hibiscus subtarriffa.*

Captain W. R. Newenham, R. N., 10, *Kensington-place, Bath*:—Three kinds of Seedling Potatoes, Cones of Cedar of Lebanon, and various kinds of Fibres for Museum.

Dr. Harvey, *Professor of Botany, Trinity College, Dublin*:—6 kinds of rare Seeds from South Africa.

Henry MacManus, Esq., *School of Art, Royal Dublin Society*:—Fine specimen of *Acacia giraffa*, Wait-a-bit Thorn.

Dr. Kidd, 205, *Great Brunswick-street*:—Specimens of New Zealand Flax, and Kangaroo Grass, from New Zealand.

Lieutenant Bridgford, R. N., 66, *Mount-street, Lower*:—Fine section of Wood, cut from one of the Cedars on Mount Lebanon, with Cone of same; also fine section of Olive Wood, cut from a tree on the Mount of Olives—for Botanical Museum.

M. Louis Von Huntle, *Nurseryman, &c., Ghent, Belgium*:—11 very rare and valuable Plants.

Mr. Bull, *Nurseryman, King's Road, Chelsea*:—16 kinds of rare and valuable Plants.

Miss Bunbury, *Picton, Bunbury, Western Australia*:—3 kinds of Seeds.

Rev. J. H. Monahan, 33, *Westland-row*:—6 kinds of Indian Seeds of Climbing Plants.

Miss Webb, *Winton Terrace, Rathgar*:—4 kinds of Bulbs and 18 kinds of Seeds from Natal.

Joseph Burke, Esq., 29th Regiment, 5, *Middle Gardiner-street*:—Parcel of Ground Nuts (*Arachis hypagæa*), from River Garubia.

General Portlock, M. R. D. S., *Lota, Booterstown*:—Parcel of Mexican Seeds.

Lieutenant Ashly La Touche, *Blackrock*:—Seeds of Cedar of Lebanon, from the Cedar Grove at Lebanon.

(Signed) D. Moore, *Curator.*

March 2, 1863.

NATURAL HISTORY MUSEUM.

ROBERT WARREN, Esq., jun., *Moyview, Ballina*:—A young female Guillemot (*Uria troile*).

J. METGE BARRY, M.D., 90, *Lower Leeson-street*:—Three Bird Skins.

PHINEAS RIALL, Esq., J.P., *Old Conna, Bray*:—A fine specimen of Granite, containing Schorl.

G. HENRY KINAHAN, Esq., Geological Survey:—Four specimens of Calamine, from the Curran Mine, Burrin, county of Clare.

PROF. JOHN R. KINAHAN, M.D. (the late):—A Sea Gull (*Larus canus*).

MONS. C. WERNES, *Magdeburg*:—A collection of Tertiary Fossils, from the north of Germany.

G. M'DOWELL, F.T.C.D.:—A Slab of polished Green Marble from Crohy, county of Donegal.

A. GARDINER, M.D., *Kingstown*:—A collection of Minerals from Tasmania.

C. J. CRAMER ROBERTS, Esq., *Sallymount, Newbridge*:—Portions of the Skeleton of the *Megaceros Hibernicus.*

J. G. KNIGHT, Esq., *Secretary to the Victorian Department International Exhibition*:—A collection of Rock Specimens, being a portion of that sent to London for exhibition.

WILLIAM ANDREWS, M.R.I.A.:—A small collection of specimens of Salmonidæ.

HENRY WARD, Esq., *Oaklands, Wolverhampton*:—A series of specimens illustrative of the manufacture of Iron in the South Staffordshire district.

J. W. CALLAGHAN, Esq., 75, *Amiens-street*:—An Owl (*Strix flammea*).

SIR F. LEOPOLD M'CLINTOCK, Captain R.N., *Merrion-square*:—A little Bustard (*Otis tetrax*).

SANDFORD PALMER, Esq., *Ballinlough, Roscrea*:—A Rat (*Mus decumanus*).

RICHARD E. POWER, M.D., H.M.S. Trent, *St. Thomas' Island, West Indies*:—28 Bird Skins, from St. Thomas' Island, West Indies.

JOHN E. CARTE, M.D., Surgeon-Major 2nd Battalion 14th Regiment, *Auckland, New Zealand*:—A few specimens of Natural History from New Zealand.

M. H. Harte, Esq., *Montpelier House, Blackheath*:—A collection of specimens, illustrating the manufacture of Iron at Low Moor; and also a collection of Oolitic Fossils.

(Signed) Alexander Carte, M. D., *Director*.

March 5, 1863.

AGRICULTURAL MUSEUM.

George M. Spong, Esq., *William-street, Limerick*:—A valuable collection of Esculent and Cereal Seeds.

Messrs. Dickson, Hogg, and Robertson, 22, *Mary-street, Dublin*:—An extensive variety of valuable Esculent and Cereal Seeds, and Seeds of plants cultivated for ornamental purposes.

A. Gardiner, M. D.:—Specimens of Oats, Wheat, Barley, Bark, Fibres, Wool, Hops, from Tasmania and the Colony of Victoria, Australia, exhibited at the late Industrial Exhibition, London.

Messrs. Drummond and Sons, *Dawson-street, Dublin*:—A case containing a collection of useful Seeds.

A. Corrigan, *Curator*.

FINE ARTS.

Colonel Arthur Phayre, *Governor of British Burmah*:—Model of a Pagoda from Burmah.

Francis Morgan, 35, *Dawson-street*:—Cast of the bust of Daniel O'Connell, by Turnerelli.

Art Exhibition Committee, 1861:—A set of Photographs of the Exhibition.

INTELLIGENCE.

EVENING SCIENTIFIC MEETINGS.

MONDAY EVENING, JANUARY 22, 1863.

REV. PROFESSOR HAUGHTON in the Chair.

MR. EMERSON REYNOLDS read a communication, "On Wood Spirit and its Detection." Published in the present number.

MR. WILLIAM ANDREWS, M. R. D. S., read a paper, "On the Irish Salmon Fisheries." Published in the present number.

MONDAY EVENING, FEBRUARY 16, 1863.

JOHN LOCKE, ESQ., in the Chair.

PROFESSOR DAVY read a paper, "On Monsieur Marchand's easy and expeditious Method of determining the amount of Butter in any sample of Milk."

ROBERT C. REEVES, LL. D. Cantab., read a paper "On the Irish Salmon Fisheries." Published in the present number.

MONDAY EVENING, MARCH 16, 1863.

REV. PROFESSOR HAUGHTON in the Chair.

EDWARD DILLON MAPOTHER, M. D., read a communication, "On the Preparation of Flesh Meat as Human Food."

MR. JOHN LOCKE read a paper, "On recent Discoveries in Australia."

A Model of a new Fire Escape, by Mr. JAMES JOSEPH BROMLOW, was exhibited.

MR. JOHN TOOHEY exhibited a sample of embossed Berlin Wool work, wrought by a new method, viz., by the use of printed tables, instead of coloured patterns.

The root of a tree of unusual length, taken out of a water cistern, was exhibited by EDWARD HAUGHTON, M. D.

The Society has been selected as the recipient of a most important donation, namely, the extensive Library and collection of Prints, the property of JASPER ROBERT JOLY, LL. D., Vicar-General of the united diocese of Tuam, Killala, and Achonry. The collection contains about 10,000 Volumes, and an equal number of unbound Prints,—all of great value, having been selected with extreme care. The Library may be thus classified :—

I. 5000 volumes of the Modern History of the principal Countries of Europe.
II. About 3000 volumes relating to the History, Topography, and Antiquities of Ireland.
III. Embracing 1000 volumes of Serials and Periodicals.
IV. Books of miscellaneous character, containing 1000 volumes.

With this addition, the Society's Library may be regarded as amongst the best, as it is certainly the most useful, in the kingdom.

DECEMBER, 1862.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Monday, ...	29·440	44	45	44	46	41	E.	0	Many, . .	Broken, . .	·150	Gloomy, breezy day.
2 Tuesday, ...	29·380	45	46	44	47	39	S. E.	0	Do. . .	Do. . . .	·030	Breezy, cold day.
3 Wednesday, . .	29·460	46	47	45	47	42	S. E.	0	Do. . .	Do. . . .	·110	Showery day.
4 Thursday, . . .	29·580	49	50	49	51	45	S. E.	0	Do. . .	Do. . . .	·310	Do.
5 Friday, ...	29·400	52	52	51	53	50	S. E.	0	Do. . .	Do. . . .	·180	Very wet day.
6 Saturday, . . .	29·580	52	52	50	55	48	S. W.	6	Do. . .	Do. . . .	·170	Fine, breezy day.
7 Sunday, ...	29·870	48	50	49	52	46	S. W.	0	Do. . .	Do. . . .	·060	Dull and cloudy.
8 Monday, ...	30·076	44	44	43	51	33	S. W.	6	Few, . .	Do. . . .	. .	Cold, breezy day.
9 Tuesday, ...	29·670	50	51	40	53	41	S. W.	3	Many, . .	Do. . . .	·090	Showery day.
10 Wednesday, . .	29·750	45	46	45	52	41	W.	7	None, . .	Do. . . .	·080	Fine, breezy day.
11 Thursday, . . .	29·750	40	40	39	44	39	W.	6	Do. . .	Do. . . .	·030	Do.
12 Friday, ...	30·100	41	42	41	42	32	S.	0	Many, . .	Do. . . .	. .	Dull and cloudy.
13 Saturday, . . .	29·920	42	42	41	44	40	W.	6	None, . .	Do. . . .	·040	Fine, breezy day.
14 Sunday, ...	30·140	42	43	42	44	39	S.	3	Many, . .	Do. . . .	. .	Fine, mild day.
15 Monday, ...	29·980	51	52	50	52	45	W.	6	Do. . .	Do. . . .	. .	Do.
16 Tuesday, ...	29·980	52	53	51	53	51	S. W.	0	Do. . .	Do. . . .	. .	Dull and cloudy, brisk breeze.
17 Wednesday, . .	30·250	42	43	41	43	35	W.	0	Do. . .	Do. . . .	·340	Dull and gloomy.
18 Thursday, . . .	29·950	51	52	51	52	40	S. W.	0	Do. . .	Do. . . .	·040	Wet, gloomy day.
19 Friday, ...	29·780	44	45	43	51	38	W.	6	Do. . .	Do. . . .	. .	Strong breeze, fine day.
20 Saturday, . . .	29·850	41	42	41	43	36	N. W.	6	Do. . .	Do. . . .	.020	Dull and changeable.
21 Sunday, ...	30·050	46	47	45	49	37	S. W.	4	Do. . .	Do. . . .	. .	Dull and mild.
22 Monday, ...	30·000	47	47	45	49	35	N. W.	0	Do. . .	Do. . . .	·160	Very wet day.
23 Tuesday, ...	30·080	48	49	47	50	42	N. W.	6	Do. . .	Do. . . .	·030	Dull and mild.
24 Wednesday, . .	30·050	47	48	47	49	43	S. W.	0	Do. . .	Do. . . .	. .	Mild, breezy day.
25 Thursday, . . .	30·180	48	48	47	50	46	S. W.	3	Do. . .	Do. . . .	. .	Do.
26 Friday, ...	30·160	48	49	47	50	40	N. W.	0	Do. . .	Do. . . .	. .	Do.
27 Saturday, . . .	30·100	50	51	49	51	43	S. W.	0	Do. . .	Do. . . .	. .	Breezy and changeable.
28 Sunday, ...	29·500	46	46	44	48	40	S. W.	3	Do. . .	Do. . . .	. .	Clear A. M., cloudy P. M.
29 Monday, ...	29·200	43	44	42	45	41	W.	6	Do. . .	Do. . . .	·050	Brisk breeze, fine day.
30 Tuesday, . . .	29·600	45	46	44	48	32	W.	6	Few, . .	Do. . . .	. .	Fine, clear day.
31 Wednesday, . .	29·800	44	44	43	47	32	S. W.	5	Many, . .	Do. . . .	. .	Clear A. M., cloudy P. M.
								88	Total Amount of Rain,		1·870 inches.	

SUMMARY OF METEOROLOGICAL TABLES FOR THE YEAR 1862.

MONTH.	Mean of Barometer, corrected, and reduced for Temperature.	Temperature of Air.				Thermometers for Dew-Point.		Hours of Sunshine.	Rain.		Wind.							
		Mean Maximum.	Mean Minimum.	Highest Maximum.	Lowest Minimum.	Dry.	Wet.		Total Amount.	Number of Days of Rain.	E.	N.E.	N.	N.W.	W.	S.W.	S.	S.E.
JANUARY, . .	29·714	45·709	37·323	10th, 51	15th, 30	44·322	42·129	60	3·030	21	1	1	1	3	7	10	1	7
FEBRUARY, .	29·963	46·214	43·393	4th, 57	2nd, 52	44·035	45·921	71	0·570	10	4	6	1	1	3	3	–	10
MARCH, . . .	29·461	47·082	38·225	6th, 58	4th, 23	47·516	45·322	92	2·990	18	1	12	1	6	5	–	–	6
APRIL, . . .	29·464	52·700	37·266	30th, 62	12th, 31	53·166	49·833	130	3·310	18	1	5	2	4	–	7	1	10
MAY, ...	29·669	59·290	40·000	17th, 67	3rd, 35	58·290	55·516	245	2·420	16	1	4	–	6	7	8	2	3
JUNE, ...	29·752	59·038	51·988	24th, 67	10th, 42	60·300	58·338	199	2·240	16	1	1	–	12	5	6	3	2
JULY, ...	29·840	61·968	49·935	24th, 68	23rd, 41	60·806	59·161	208	3·380	18	5	–	–	10	5	10	–	1
AUGUST, . .	29·868	63·709	48·888	27th, 68	19th, 45	62·415	60·709	230	1·840	12	2	–	–	7	12	6	1	8
SEPTEMBER, .	29·984	61·966	47·300	8th, 68	18th, 40	60·838	56·533	198	2·140	10	6	7	1	3	6	4	–	3
OCTOBER, . .	29·544	55·419	43·082	3rd, 66	30th, 27	47·967	46·580	140	2·710	20	2	3	–	2	6	12	3	3
NOVEMBER, .	29·864	44·866	32·166	2nd, 57	18th, 25	43·500	42·400	150	1·440	14	1	2	1	8	2	8	–	3
DECEMBER, .	29·582	45·516	40·387	6th, 55	12th, 32	46·967	45·258	88	1·870	17	1	–	–	4	8	12	2	4
YEARLY MEAN,	29·720	53·604	44·149	– –	– –	52·848	50·724	–										
YEARLY TOTAL,	– –	– –	– –	– –	– –	– –	– –	1811	27·940	190	26	41	7	66	66	86	13	60

APPENDIX.

METEOROLOGICAL JOURNAL,

KEPT AT

The Royal Dublin Society's Botanic Garden, Glasnebin,

[HEIGHT ABOVE LEVEL OF SEA, 65 FEET],

FROM

1st JANUARY, 1863.

JANUARY, 1863.

DATE. Day. At 4 o'Clock, P. M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Thursday, . . .	29·400	43	43	41	45	42	S. W.	0	Many, . .	Broken, . .	·500	Gloomy, wet day.
2 Friday,.	29·400	39	39	38	39	39	W.	6	None, . .	Do. . . .	. .	Cold, breezy day.
3 Saturday, . . .	29·290	37	37	36	45	32	S. W.	5	Many, . .	Do. . . .	. .	Dull and gloomy.
4 Sunday, ...	29·050	39	40	38	42	34	S. W.	6	Do. . .	Do. . . .	·100	Fine, but cold.
5 Monday, ...	28·700	38	40	38	42	38	W.	5	Few, . .	Do. . . .	. .	Fine, clear day.
6 Tuesday, ...	28·970	37	37	36	39	29	E.	0	Many, . .	Do. . . .	·110	Cold, wet day.
7 Wednesday,. . .	29·130	40	40	39	40	33	W.	0	Do. . .	Do. . . .	·400	Do.
8 Thursday, . . .	29·350	39	39	37	41	35	N. W.	0	Do. . .	Do. . . .	·130	Showery day.
9 Friday,.	29·600	42	42	40	42	39	S. W.	0	Do. . .	Do. . . .	·180	Very wet day.
10 Saturday,. . . .	29·700	39	40	38	40	37	E.	2	Do. . .	Do. . . .	·160	Dull and gloomy.
11 Sunday, ...	29·840	40	40	39	40	30	S. E.	6	None, . .	. . . . . .	. .	Fine, clear day.
12 Monday, ...	29·780	42	43	42	44	30	S. W.	4	Do. .	. . . . . .	·060	Rain A. M., fair P. M.
13 Tuesday, ...	29·780	39	39	37	41	34	N. E.	2	Many, . .	Broken, . .	·050	Cold and showery.
14 Wednesday,. . .	30·350	41	41	40	42	31	S. W.	6	Do. . .	Do. . . .	·020	Very fine day.
15 Thursday, . . .	30·200	40	41	40	43	39	N. W.	3	Do. . .	Do. . . .	. .	Fine, mild day.
16 Friday,.	30·000	42	42	40	42	40	S. W.	5	Do. . .	Do. . . .	. .	Do.
17 Saturday,. . . .	29·900	40	41	39	43	40	S. W.	0	Do. . .	Do. . . .	. .	Dull and breezy.
18 Sunday, ...	29·780	41	42	40	43	37	N. W.	5	Do. . .	Do. . . .	·230	Fine A. M., changeable P. M.
19 Monday, ...	29·500	46	46	44	48	41	W.	8	Do. . .	Do. . . .	·010	Gloomy and stormy.
20 Tuesday, ...	29·260	36	39	35	39	35	W.	4	Do. . .	Do. . . .	·180	Snow, showery, cold, and stormy.
21 Wednesday,. . .	29·620	43	44	42	45	34	S. W.	4	Do. . .	Do. . . .	·020	Dull and cloudy.
22 Thursday, . . .	29·380	51	52	50	52	42	S. W.	0	Do. . .	Do. . . .	·010	Gloomy, breezy day.
23 Friday,.	29·450	39	39	37	40	36	S. W.	3	Do. . .	Do. . . .	·170	Cold and showery.
24 Saturday,. . . .	29·700	40	40	39	42	35	N. W.	2	Do. . .	Do. . . .	·060	Thunder and heavy showers.
25 Sunday, ...	30·050	47	48	46	49	38	S. W.	5	Do. . .	Do. . . .	·020	Breezy and showery.
26 Monday, ...	29·550	51	51	49	53	45	S.	3	Do. . .	Do. . . .	·020	Do.
27 Tuesday, ...	30·330	42	43	41	50	36	W.	8	Do. . .	Do. . . .	. .	Fine breezy day.
28 Wednesday,. . .	30·040	46	49	47	50	32	S. W.	0	Do. . .	Do. . . .	. .	Gloomy and breezy.
29 Thursday, . . .	29·520	50	51	50	52	47	S. W.	2	Do. . .	Do. . . .	·020	Do.
30 Friday, ...	29·130	45	45	44	49	45	W.	0	Do. . .	Do. . . .	·140	Showery day.
31 Saturday,. . . .	29·450	44	45	43	49	35	S. W.	3	Do. . .	Do. . . .	. .	Fine breezy day.
								92	Total Amount of Rain,		2·490	inches.

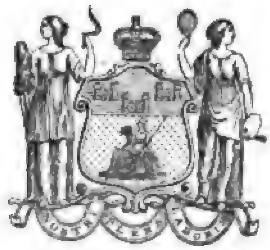
No. XXX.] JULY. [Price 1s. 6d.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

Published Quarterly.



CONTENTS:

	PAGE.
1. Mr. Locke on Remarkable Discoveries in Central Australia (Third Paper),	141
2. Mr. B. Haughton on the Aurora Borealis of 1862,	151
3. Dr. Mapother on the Preparation of Flesh Meat as Human Food,	153
4. Dr. Carte and Mr. Baily on a New Plesiosaurus,	160
5. Return of Donations to the Royal Dublin Society,	170
6. Intelligence,	175
Appendix—Meteorological Journal for the Months of February, March, April, and May, 1863,	iii

DUBLIN:
HODGES, SMITH, AND CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.
1863.

M. H. Gill, Printer to the Royal Dublin Society.

Royal Dublin Society.

FOUNDED 1731, INCORPORATED 1749.

The Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Registrar:—

Life Membership, ...	£21	0	0
Annual Membership (with £3 3s. Entrance Fee),	2	2	0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15s.

I.—Meetings of the Society.

1. *Stated and Ordinary Meetings.*

The Society meets at 2 o'Clock P. M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday in November.

2. *Evening Scientific Meetings.*

Meetings of the Society and of the Associated Societies, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session. The business is conducted in the following sections:—

I. Agriculture and Rural Economy, and Horticulture.

II. Fine Arts.

III. Natural Sciences, including Zoology, Botany, Physiology, Mineralogy, Geology, Physical and Descriptive Geography.

IV. Experimental Sciences, including Physics, Chemistry, Physiology, Meteorology, and the Mechanical Arts.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society, and in the Quarterly Journal of Science.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5s. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6*d*. each; or to twelve for 5s., available for any of the ordinary Meetings throughout the Session.

The Council and Committees.

The Council, which comes into office in January, meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

Eight Standing Committees are annually elected, as follows:—1. Agriculture; 2. Botany; 3. Chemistry; 4. Fine Arts; 5. Library; 6. Manufactures; 7. Natural History; 8. Natural Philosophy. Besides these are the Evening Meetings Committee and Sectional and occasional Committees.

[*For continuation, see page 3 of Cover.*

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

JULY, 1863.

XIII.—*Remarkable Discoveries in Central Australia.* J. M'Douall Stuart's *Third and successful Expedition, starting from Adelaide, and penetrating through the Geographical Centre to the Northern Coast,* 1861–2, *with Map, showing all the routes.* By John Locke, M. R. D. S.

[THIRD PAPER.]

[Read on Monday Evening, March 16, 1863.]

On 18th March, 1861, I read a paper before this Society, describing John M'Douall Stuart's first attempt, in 1860, to cross the Austral Continent. On that occasion he overpassed the geographical centre, reaching latitude 18° 57′, where an attack from a large body of natives on his small party, consisting only of three persons, himself included, obliged his return. January 1, 1861, he attempted the transit a second time, with a more numerous and better-equipped party, and reached the further latitude of 17° in a well-grassed and copiously watered region, when insufficient provisions obliged his return without accomplishing the desired object. An account of this second attempt was communicated to the Society on the 24th December, 1861. And now I have the honour and satisfaction of publicly acknowledging the receipt of Stuart's journals of his third and completely successful expedition from Adelaide, through the geographical centre of the Continent to the Indian Ocean, traversing a country generally practicable for the settler, and, especially in the northern part, rich in the chief requisites of colonization.

These maps, lithographed in Adelaide, and transmitted through the kindness of Mr. John Tuthill Bagot, a member of the South Australian House of Assembly, represent Stuart's three expeditions, and M'Kinlay's route in search of Burke to the tidal waters of the Flinders, and thence

to Port Denison in Queensland. However, neither Burke, nor any of those who followed his tracks, reached the Carpentarian coast. It was reserved for the indomitable Stuart alone to solve the mystery of the central regions of this great division of the globe, and plant the British flag on the shores of the Indian Ocean. His several routes will be more easily and distinctly traced on this large map,* representing a trans-central section of Australia from south to north.

On 20th September, 1861, he started from Moolooloo, one of the outlying pastoral stations of South Australia, with nine companions, including Mr. Waterhouse, a distinguished naturalist; and on 10th of same month, in the following year, arrived again at that station on his return to Adelaide.

On 25th of July, 1862, he reached the northern shore on Van Diemen's Gulf, lat. 12° 14′ 50″; and, having cleared an open space, selected the tallest tree, lopped off the lower limbs, and hoisted the Union Jack, with his own name sown in the centre on the loftiest branch. In continuing the description of this happy event, I quote the simple yet stirring words of Stuart's Journal:—

"When this was completed, the party gave three cheers; and Mr. Kekwick, my second in command, then addressed me, congratulating me on having accomplished this great and important undertaking, to which I replied; Mr. Waterhouse also spoke a few words on same subject; and then all gave three cheers for the Queen, and three for the Prince of Wales. At one foot south from the tree is buried, at a depth of about eight inches, a tin case containing a paper with notice of our arrival, signed by myself and all my party. I have named this bay Chambers' Bay, in honour of Miss Chambers, who kindly presented me with the flag which I have planted this day, and I hope it may be the first sign of the dawn of approaching civilization. Exactly this day nine months our party, before leaving Adelaide, had lunch between 11 and 12 o'clock at the house of Mr. Chambers; and Mr. John Bentham Neales proposed success to me, and wished that I might plant the Union Jack on the north coast; and now nine months after, at same hour, we hoisted our flag on the shores of Chambers' Bay. The sea has been reached, which was the chief object of the expedition, and a practicable route found through a splendid country from Newcastle Water to it, abounding for a great part of the way in running streams, well stocked with fish; and this has been accomplished during the dry season of the year."

However, it would appear from a closer examination of the details, that it is only after surmounting a dense belt of scrub, and a series of sterile stony rises, that the country north of Newcastle Water assumes

* Drawn by Thomas Locke, C. E.—Petermann's map of Australia, attached to the "Geographische Notizen," now being published at Gotha, is incomparably the completest that has yet appeared. It presents an elaborate graphic history of discoveries up to the present time, and is a model of clearness, correctness, and elegance. London agents, Williams and Norgate.

such a promising aspect; and that numerous springs and water-courses were found in every direction intersecting and surrounding the track of Stuart's route. Indeed, even in the arid and level plains of the more central districts substratal water of potable quality is often found at moderate depths, as I have exemplified in my former papers. To give another instance now—Mr. M'Kinlay on one occasion states, that he "started the black fellows and whites to dig a well close by the depôt; at eight feet eight inches struck good water. On the morrow deepened the well to nine feet six inches; the first four feet clay and fine sand, next three feet and a-half gypsum and blue clay, then again clay and very fine sand, through which water rushed in from every quarter." The dwarfed and spinous undergrowths that cover vast tracts, and are ineradicable even by the agency of fire, are a more serious obstacle to settlement than deficiency of water in the interior. Again, if the natives confined their reckless love of mischief to setting fire only to the scrub, there would be no cause of complaint; but their cowardly malice in firing the grass exposed the travellers on several occasions to the danger of a terrible death; and if severe and decisive measures are not adopted to deter them from the practice, settlement of the interior will be impracticable. With the exception of firing the grass, Stuart experienced no annoyance from the natives on his last expedition; nor does he relate any incident respecting them worthy of record. On his advance he cut his initials on a tree at M'Gorrery's Ponds, lat. 16° 30′, and on his return observed that the natives had cut near the letters a figure resembling the head of a stone hatchet or tomahawk. This is the only specimen given of their ingenuity and intelligence, and probably was intended to convey a threat of what they would do, if they dared.

The stolid obstinacy of the aborigines in adhering to their miserable life of savagery, with the full light of intellectual power and Christian civilization before their eyes, is a fact as marvellous as the proved impracticability of arresting their decadence in presence of a superior race; and this contemporaneous existence of barbarism and progress, of the age of stone and age of all the metals, may supply instructive suggestions on a subject which has lately been discussed with unreflective haste and rashness by some even of the highest scientific authorities.

Human development has not consisted in a generally uniform gradation from primitive barbarism to civilization; but a Pariah people, outliers, as it were, of our race, have been found in all the great divisions of the globe. These, fallen by their own wilful and premeditated error from a condition of comparative enlightenment in the primeval ages, have been unable, without extern aid, to emerge from their condition of barbarism; and sometimes, as in the instance of the Tasmanian aborigines, seem devoted to extinction, notwithstanding all the laborious solicitude of Christian philanthropy to save even a remnant from their doom.

The very fauna and flora of Australia are at this time undergoing, beneath our colonising influence, a mutation as complete and radical as any geological revolution could effect; and if the Papuans of that ex-

tensive* region were extinct, the stone implements scattered over the plains, or imbedded in refuse heaps of shells of edible fish on the banks of the creeks or inland waters, would indicate the same design and phase of existence as similar remains discovered throughout Europe beneath the peat, and lower still in the alluvia of the pleistocene. Now, the obvious induction from these facts would be, that as now, so in former ages, as far back as history is confirmed by the tangible records of archæology, human life has been presented under the same contemporaneous contrast of decadence and progress. Thus, in this green island of ours, it may have been, that an ancient debased race gradually declined in presence of a more enlightened immigrant people; and, retreating into the forests and marshes of the interior, there hunted, or rather woried to death, with their rude weapons of flint, now so frequently found beneath the peat, the timid broad-antlered giant, and other great pachyderms,* until at length both themselves and the animals that supplied their food alike perished; giving place to men of superior mental cultivation, who introduced a new fauna and flora, as British colonists are in this century accomplishing at the antipodes. However, no historic notice, not even a solitary tradition or romantic myth, of either of these races has reached us; and so may it have been, likewise, that the mound

---

* The uniformity between these primitive implements, discovered in every region of the globe, is a very curious and interesting fact; and doubtless they would also be found sunken in the Australian subsoil. Here I may repeat some observations on this subject, communicated by me to a Scientific Society in November, 1861:—

"If light meadow land receive a heavy top-dressing of calcareous sand, and remain unbroken for eight or ten years, spade or plough will then disclose the sand in an even layer in the subsoil from five to seven inches beneath the surface, according to the friability of the soil, which it has permeated by force of superior specific gravity. Does not this familiar fact suggest a satisfactory solution of the archæological puzzle of the flint implements discovered in the diluvium of the pleistocene; and likewise of Bunsen's statement that fragments of pottery have been found in the lowest alluvies of the Nilotic region, which must have been deposited long before the human historic epoch. The former apparently anomalous phenomena have been too hastily assumed as proofs of the coexistence of man with the monster mammals of an era antedating by many thousand years the received chronology of the Adamic creation; and the position of those primitive implements may be accounted for by supposing them to have sunk in the lapse of long periods from post-tertiary surfaces through intervening strata to the drift. This might be expressed in the form of a rule, to be observed both in stratiform and fossiliferous exploration—that fragments or particles, specifically heavier than the soils upon which they have been originally deposited, will persistently descend, until they reach a denser clay, heavier gravel, or the solid rock itself. Aqueous infiltration, cuspidal form of the descending material, pressure of superinduced masses, and the reciprocal conditions of weight and adhesiveness, will, of course, modify the rate of subsidence of the transitive fragments according to the comparative circumstances in each instance; but down they will go, as surely as lead sinks in water; while the flying sand above, and that secret vegetable chemistry which abstracts carbon from the atmosphere, gradually increase their depth by the continuous, though scarcely perceptible, increments of the superficial covering. Thus, heavier matters sink, while the lighter human or animal remains decay, and mingle with the soil on which they fall."

* The auroch, or European bison, now only met with in the marshy forests of Russian Poland, is perhaps the sole remnant of the huge pachyderms of the era of the *Cervus giganteus Hibernicus.*

builders of the Mississippi were contemporaries of the architects of those gorgeous fanes in Central America which are covered with an undecyphered symbolic sculpture.

Even supposing the geologist to be successful in welding human history upon a distinct geologic era, his success could only establish the secular conditions of a limited region; and these are likely to be different, both in circumstances of time and physical relations, from the disclosures of similar researches in other parts of the world.

We shall therefore reason more satisfactorily from the few and scattered intimations supplied by archæological discovery upon the antiquity of man, if we carefully note the distinction between indefinite geologic durations and historic time. The extant creational phase of Australia, for instance, exhibits no gradational improvement in type, but rather decline; the evidence of alternating formative agency is not legible in the everlasting rock. Marsupial and apteræ remain unchanged, save in dwindled size; and coincide, or nearly so, with the pre-historic oolotic fauna of other and far distant regions. Australia, in short, is altogether strange and isolated, whether contemplated in its organic or inorganic aspects; as these present no mutuality of fitness (so to speak) with the human idea of time. Truly, that region may be more significantly denominated a new world to the men of this generation, than America was to Columbus 370 years ago. There dwell together, yet unmixed, the savage of a remote and unknown past, and an immigrant people, who, both in relation of their epoch, and character of their civilization, approximate the sixth millennium of the history of man upon the globe.

Now, these brief remarks, for which the subject gives fair occasion, are not intended to intrude the historic evidences of the Mosaic record into the domain of comparative geology; but rather to question the converse of this proposition, so rashly theorized in the materialistic hypotheses of our day. Certainly, if Scripture history be authentic, enlightenment and barbarism were exhibited in contrast, even in the primeval societies of man; while their associated continuance ever since awaits its providential solution in the future; and *pre-historic*, in application to the human species, is altogether a misnomer, if intended to intimate a period when an enlightened people, capable of transmitting the record of their era, *did not exist*, though philology may have failed as yet to interpret the media of transmission, or the record itself may have perished in the lapse of ages.

Stuart incurred no disaster from inundations, of which there were several dangerous intimations during same year along the path of his fellow explorer, M'Kinlay, in the eastern interior. On one occasion, March 10, in lat. 25° 50′, he narrowly escaped destruction, by retreating to a rising ground until the waters subsided. The natives pointed, and called "arimitha"—their name for these sudden and destructive floods; and there was the whole valley* (to use M'Kinlay's words), "a

* This extensive tract probably is depressed below the sea level, and was formerly, like other similarly depressed tracts, the bed of a salt lake.

perfect sea, rising fast." Again, six weeks subsequently, in lat. 16°, travelling in the dried bed of a creek, he observed, forty feet above his head, "logs, rubbish, and immense trees uprooted, or snapped across by a former flood." These floods, or rather deluges, sufficiently account for a curious circumstance noticed in the eastern interior, *i. e.*, the occurrence of strange trees and shrubs—in fact, an insulated and peculiar flora, on the crowns of the low detached hills or ranges rising from the stony and sterile plains. Former inundations had swept away the primal vegetation, with all living things, in its destructive career, except in these insulated spots above the reach of the flood. We can realize a faint idea of the destructive results of denudation—the transport of huge rocky fragments, the formation of osseous breccias, and the accumulation of animal remains and ancient stone weapons in caves or fissures—when there is represented to the imagination such a deluge, driving before the wind across a vast area, like tidal waters upon a lee shore. The extent and suddenness of these atmospheric changes render necessary a very careful supervision, previously to establishing settlements in the interior; such as elevation of the locality, and sufficiency of deep water courses, as safety channels. The absence of any lofty ranges, worthy of being called mountains, is perhaps the chief cause of the alternation of excessive rains with long droughts in the interior; in fact, Australia, even in most of its extra-tropical districts, possesses a tropical climate.

What a beneficent ministry is that of mountains in arresting the passing clouds, and becoming tractors to the waters suspended within their distended folds; condensing every breath of warm air that touches the elevated summits of sustained cold, and thus creating permanent lake, and ever-flowing stream, as well as the transient shower that fertilizes our fields! Were Ireland without her mountains, phenomena similar to the "arimitha" of the remote south would be manifested. As the equatorial currents of air, laden with aqueous vapour, flow steadily for months together, until met by the cold strata from the Antarctic; so the chill and dry easterly winds in Ireland would strike and overlap the moist and warm vapour borne from the Atlantic, until at length the elastic tension burst the enveloping pluvious belt; and then down rush rivers from the clouds, with all the terrible accompaniments of a wide-spread devastation.

As to modes of travel and dietary, we infer from the combined experience of Stuart and M'Kinlay the same conclusions stated in former papers read before this Society. Camels are the surest footed carriers, and are more thrifty feeders, and less likely to stray than the horse and ox. M'Kinlay found that the sheep, which he brought with him for food, kept their condition better than the other animals, were easily kept together, and became very useful in furnishing fresh meat, and so preventing scurvy, from which Stuart and his party suffered grievously. He also used a species of spinach, called by the natives "cullie;" and a vetch, strong in taste, but nutritious, which the natives bruise between stones, then mix with water into the consistency of damper, and bake

in the ashes. I received some pods of this plant, which are now growing in our Botanic Garden. M'Kinlay lost a horse from some unaccountable disease, and the stud of both travellers were weak and sickly throughout. This fatality to horses may probably arise from some poisonous plant. In this country, for example, if cattle are depastured on soils abounding with the wild parsley or other unwholesome plants, they will sicken, and die, if not removed.

From latitude 13° 20′ to the north coast, Stuart found the flora assuming a more tropical type. The fan palm, cabbage palm, and others of that graceful tribe, bordered the streams; several varieties of the vine were observed, also fruits resembling the plum, pomegranate, and orange; and shrubs and flowers of new and beautiful species abounded. The rivers also in this region, mostly flowing seaward, teemed with various kinds of fish, and the forests were full of birds, many of them new to our traveller. In lat. 12° 49′ he describes a lily, which in beauty, if not in size, would rival the Victoria regia. The heart-shaped leaf exceeds a foot in its greatest diameter; the blossom is tulip-shaped, with petals of a deep and brilliant rose colour, six inches long; and the seeds are contained in a vessel resembling the rose of a watering-pot, their golden-coloured apices extruding through the openings.

This rich and fertile country seems suitable for production of cotton, wood, water, tropical temperature, and a virgin soil, being all present, and the one indispensable requisite of labour alone wanting. In lat. 13° 44′ 14″ he came to an elevated plateau, which presented a strange and very interesting sample of stratification. "The top course (he writes) of this table land is a layer of magnetic ironstone, which deflected my compass upwards of 20°: underneath is a layer of red sandstone, and below that an immense mass of white sandstone, very soft, and crumbling away from action of the atmosphere." Again, in same vicinity, bordering the Adelaide River, he passes over a great number of "steep stony rises, composed of conglomerate quartz, resting upon a course of slate, lying north-west, and nearly perpendicular; also some layers of ironstone, and a sharp rectangular grey flint." "I should think (he continues) this a likely place to find gold, from the quantity of quartz, its colour, and having so lately traversed an extensive basaltic and granite country; the conglomerate quartz being bedded in iron, and the slate perpendicular, are good signs." Now, gold is found in Australia not only in the matrix of white quartz veins and interstices in the primitive rock, but also frequently associated with black magnetic ironsand in the superficial detritus; and it is not unlikely that Stuart's conjecture may turn out correct; but his notices respecting mineralogy, botany, and other branches of natural history, are so few and incomplete, that we must wait for the report of Mr. Waterhouse, naturalist to the expedition, ere we possess sufficient information to enter upon the discussion of these important and interesting subjects.*

---

* See Appendix.

If South Australia puts forward a claim, founded on priority of discovery, for an extension of territory to the north coast, bisecting the continent by a comparatively narrow strip, it is not likely to be entertained by the home government; but if a capacious and secure roadstead be discovered within the Gulf of Van Diemen,* there does not seem any financial hindrance to the merchants of Adelaide establishing a mercantile marine and goods depôt on the northern coast, thereby avoiding the perils and delays of the circuitous ocean routes, *i. e.*, provided the overland transit is ascertained to be not only safe and facile, but also less expensive for transport of cattle and merchandise. The abandonment in 1847, after nine years' trial, of Port Essington (which is only about one degree north of Stuart's terminus), in consequence of insalubrity of climate, unproductiveness of soil, and want of markets, will render the British Government cautious in encouraging colonial settlement without a careful preliminary survey, and examination, especially of the climate, and capabilities of the maritime districts.

Again, Government may be disposed to organize a penal settlement on the northern coast. The nucleus of such settlement would be over 1200 miles from the nearest colonial capital; and the measure might likewise be rendered less distasteful, by making it available for Australian as well as British convicts. Within little more than a half century the state executive has receded from sanguinary severity to the other extreme of injudicious lenity; and statesmen are gradually inclining to the necessity of re-adopting the punishment of exile for repeated and incorrigible offenders, as desirable not only in a financial view, but chiefly to preserve social and civil interests at home from the dangers involved in the overwhelming increase of criminals among a dense population within a very limited territory; at same time not altogether abrogating the reformatory system, which may serve the co-ordinate purpose of neutralizing crime in its incipience in the case of juvenile offenders; just as sanitary preventives to counteract the injurious effects of miasmata are combined with great conduits for expulsion of the sewage, which, if dammed back, would be destructive of health and life in our cities. The commonwealth is necessarily insecure, when the foul streams of crime are allowed to stagnate and become absorbed into the healthful elements of social life.

---

* The embouchure of the Adelaide, not far from Stuart's terminus, is half a mile wide, with "a perfect ship entrance," as described by Lieutenant Helpman, who, in July, 1839, ascended the river in boats sixty miles, or double that distance by the bends. Half way, the river was 250 yards wide, with seven fathoms water; and at the extreme point reached, where snags and fallen trees interrupted further progress, the river was sixty yards wide, with three fathoms water.

Some point on this river would probably form the most convenient terminus for a trans-Australian telegraph along Stuart's route. Two other plans have been proposed, by M'Kinlay's route, which is more easily reached from Adelaide than from Melbourne; and a coastwise track from Adelaide to Queensland. The last would be the most circuitous, but would touch all the principal outlets of traffic; pole timber also would be more easily supplied for the wires, and the other materials would be cheaper by sea-borne carriage.

In thus adverting to the probability of a partial recurrence to the punishment of transportation, I by no means presume to advocate that measure with special reference to Australia; but certainly a great proportion of our adult convicts would be employed more advantageously (in a moral point of view) for themselves, and for the British world at large, in cultivating cotton on the shores of Van Diemen's Gulf, or even collecting the precious metal in Stuart's gold fields on the Adelaide (supposing his conjecture true) than in gaols and reformatories at home, where their mode of living is in every respect more comfortable than that of our honest agricultural labourers, or the humbler artisans of our towns.

However, the prosperity, wealth, and public spirit of these great colonial commonwealths entitle their declared opinion upon Australian matters to respectful consideration; the exports according to last year's returns amounting to nearly twenty-seven millions, and imports exceeding twenty-three millions; while the annual revenue, raised by a light and equitable taxation, is upwards of six millions.

The progress of Australia, (including Tasmania) is, under all circumstances, unparalleled in the annals of colonizing enterprise. Just three quarters of a century since, in 1788, 1037 persons, reckoning all ranks and ages—officials, settlers, convicts, and their children—landed on the shores of Port Jackson; and the last census reports a population of 1,240,000 souls, leaving out the aborigines, computed to be about a quarter of a million, and who are declining in inverse ratio to the increase of the immigrant race. Now, if we assume the same numerical progress for next seventy-five years, the white population in 1940 would vastly exceed the total present population of the globe. It is only by analogy that we can approximate the probable future of any vast and imperfectly known portion of the earth's surface; and instituting the other comparison, of increase in proportion to area, the resulting estimate would fall not far short of the former conclusion in numbers. For example, the population of China proper is computed at 362 millions, occupying an area of 1,300,000 square miles; but the united area of Australia and Tasmania is 3,024,000 square miles, or twice and a quarter that of China; and, under similar circumstances of capability for inhabitation, would therefore accommodate 800 millions. Of course, it is not warrantable to urge such comparisons to their precise arithmetical inferences; but allowing for all disadvantages, whether known or conjectured, in the yet unexplored interior, it is not unlikely that there are some present here this evening who may live to see Australia tenanted by twenty millions, speaking the language of England, and prospering under her religion, institutions, and laws.

APPENDIX.

Of the flora and fauna of the interior there is but scant record in those portions of the Journals of Mr. Waterhouse which have as yet come to light. The prevailing flora of the central arid tracts consists

chiefly of mulgas, cassias, acacias, spinifex (the porcupine grass of the colonists), and gum trees on the banks of the creeks, of stunted and distorted growth. Of the natural history of the rich northern country, the future site of a prosperous and populous settlement, no account whatever is given; but of the geology of the interior a few observations are noted, of considerable interest, relative to volcanic phenomena, and the lithological character of the strata.

At Mount Hamilton Station, lat. 26° 47′, there occurs a beautiful limpid spring, welling from the summit of a volcanic cone, which rises 20 feet above the plain. A few miles further north are the Blanchecup springs, discovered by Major Warburton. The principal of these springs up through the fissures of an ancient crater, and overflows the summit of a truncated cone, about 40 feet wide, and elevated about the same height from the plain. The water is singularly transparent, and gracefully fringed round with tall green reeds; and the lava is so hard and compact, as to resemble a siliceous limestone.

The Freeling springs, lat. 22° 35′, present another remarkable example of unfailing supplies of water issuing from ancient volcanic fissures; but here the water is so strongly mineralized, as to be unfit for drinking. Many other instances of volcanic cones were met with in the interior, several of them penetrating through a marine argillaceous deposit, abounding in fossil sea shells; from which it is inferred, that these cones were of submarine origin. On the other hand, it would seem that the upheaval of a great part of the central plains was marked by lacustrine conditions, fresh water shells, chiefly paludina and unio, being found in great quantity scattered over the plains surrounding the waterholes; as, for instance, on Sturt's plains, comprising the extensive well-grassed country bordering on the chain of large deep ponds which Stuart named Newcastle water. These ponds Mr. Waterhouse conjectures to be the residua of an ancient fresh water lake, which covered a vast extent of the interior in about the 17th and 18th degrees of latitude; and he infers that the central country is gradually drying up, in consequence of the evaporation exceeding the fall of rain, and the gypsous tenacious clay checking the formation of springs by preventing the infiltration of water. There seem to be no settled or annually recurrent rainy seasons; for, although the character of many of the dry watercourses proves that they were occasioned by extraordinary floods, still the size of the gnarled gum trees and acacias, growing in their beds, equally demonstrates the long lapse of years since the occurrence of such floods. Mr. Waterhouse manifestly does not consider the colonization of the interior desirable, or even practicable in some districts.

The Mac Donnell range, a little south of the tropic, from 1500 to 2000 feet high, was the only land of considerable elevation met with in the interior; and this range Mr. Waterhouse considers to be the natural centre of that part of the continent. The prevailing rocks were gneiss of peculiar hardness and compactness; a variety of granites, some not observed before; argillaceous schist; silex, sometimes of a drab colour; ironstone; and occasionally a very rich veinstone.

He describes a curious section of the strata on the banks of a creek, named the Finke, in lat. 27° 30,—the base, a soft argillaceous schist horizontally stratified, with numerous vertical fissures, interstratified with a free sandstone of various colours, and topped by a curious siliceous rock, of a drab colour, and frequent conchoidal fracture; appearing like hard baked earthenware. The splintered siliceous stones, strewn thickly over vast plains in this latitude, Mr. Waterhouse considers to be derived from this fissile siliceous rock, floods having undermined the argillaceous schist, and then the overlying rock falling in, and being separated in small fragments, and swept away by the rush of water.

Mr. Waterhouse has been directed by the South Australian Government to prepare a detailed account of his discoveries, with illustrations; and the Royal Dublin Society may be so fortunate as to obtain specimens of natural history from his valuable collections through the intervention of our corresponding member, John Tuthill Bagot, of Adelaide.

J. L.

XIV.—*The Aurora Borealis of December* 14, 1862 ("*Northern Corona*"), *as observed by Messrs. B. Haughton, Dawson Massey, and the Rev. W. C. Duke, at Rossmore, in the County of Carlow.* Communicated by BENJAMIN HAUGHTON, Esq., of Carlow.

[Read on Monday Evening, April 20, 1863.]

ON Sunday night, December 14, 1862, at 8.30, as we were crossing the *Rossmore* hills, at 1150 feet above the sea level, and which form the western watershed of the River Barrow catchment basin, we observed a grand and most beautiful phase of the aurora borealis.

It was altogether different from any aurora that I had ever before seen, having the appearance of a dome of flame of various colours—crimson, green, and faint yellow (I could not discover any of the blues), intermingled with that peculiar white light so frequently to be seen in the rays of the ordinary segmental aurora.

The flashes of coloured light proceeded from a nucleus or centre of pale, dull, opaque material, having an irregularly serrated outline, of about 4° diameter, situated on or near the meridian line, and at a distance, as well as I could measure by the eye, of 55° from the pole star. It somewhat resembled in shape the island of Iceland.

Its position was constant, and its aspect unvarying, throughout its existence of say half an hour from 8.30.

It shot forth the auroral flash to all the points of the compass, each flash being a broad and variously-shaped band of coloured light; some were pear-shaped, some oval, some ribbon-like; the colour defined, but not brilliant; the motion deliberate, like that of the railway train when seen to pass along the country from a distance.

What chiefly attracted my attention, however, was the unique and unusual character of this exquisite meteor. I had been familiar with the ordinary segmental aurora from childhood (of which I had observed a very fine example on the early evening of November 7, 1861), but had never before witnessed this domed aurora, with its [eccentric] focus or centre fast fixed at 18° south of the zenith. Why this eccentricity? It must have a cause. Why has this aurora (for it must be such) transferred its basis of action from the familiar, old-fashioned, northern azimuth to the zenith? We were quite bewildered; yet the fact firmly addressed itself to our minds, and was treasured up there for subsequent elucidation.

We threw ourselves on our backs upon the frost-smitten grass, and revelled in the changing beauties of the wondrous scene until prudence got the better of curiosity, and we arose and tramped over the brow of the mountain homeward.

During our walk we discussed the question, and made some observations as to the intensity of the light, the appearance of the stars, and their situation, &c., as follow:—

There was no moon, and yet the light was sufficient to enable us to see the hour by our watches. I opened a letter; I could not read it, but I could see the lines of writing distinctly.

Orion's belt pointed right into the centre of the nucleus of the aurora; Auriga, Taurus, Casseiopœia, lay around. We could not say what were the stars under cover of the centre, as it was a dense patch of cloud light which eclipsed the stars both under and around it for a radius of 10°. Outside of this circle the stars were clearly visible, even through the kaleidoscopic flashes. The latter travelled radially from their centre towards the horizon, where they were lost in a zone of cumulo streaks, which lay mathematically parallel to the horizon, the whole conveying the idea of a concave coach-wheel, if the comparison be admissible in connexion with such a sublime phenomenon.

At the northern region of the horizon, the segmental aurora of the familiar pale silver colour was visible throughout, but obscured by the presence of its congener and more gorgeous companion.

The question constantly recurred,—which will win, dome or segment? Alas! for the beautiful parvenu: it had vanished within half an hour from the time we first observed it; the dull northern segmental light became master of the situation, and with vindictive triumph proclaimed its victory, by sending its silver rays from its home in the magnetic north up through the zenith, and almost into the southern azimuth, through an arc of 180°, for some hours after.

This aurora was seen by several friends of mine as early as 5.30 P.M., but without the coloured light.

It may be worth notice that a somewhat similar aurora was observed by "The Times'" correspondent in the Southern States on December 12, two days before that on which I saw it. I quote his words:

"The aurora borealis which overspread the heavens, and darted

blood-red tongues of flame swiftly from the meridian down to the horizon, was accepted by the Confederates, as the cross outlined on the sky was accepted by Constantine, as an earnest of assured victory."

The day following, the 13th, was the day of the memorable battle of Fredericksburg.

I have since learned from Kaemtz's valuable book on Meteorology, through the kindness of Rev. Professor Haughton, that this description of aurora is well known to him, and that it is called the "*Northern Corona.*" He describes it thus:—"The whole sky seems a cupola on fire, supported by columns of divers colours, the centre of which is on the dipping needle produced."

XV.—*On the Preparation of Flesh Meat as Human Food.* By E. D. MAPOTHER, M.D., Fellow and Demonstrator of Anatomy R. C. S., and Surgeon to St. Vincent's Hospital.

[Read on Monday Evening, March 16, 1868.]

THE importance of all subjects concerning public health and the economy of human food must be my excuse for troubling the meeting with some points in relation to the preparation of flesh meat. I have long regarded the present mode of slaughtering animals as most wasteful and injurious; for it removes all the blood, most of the lymph and chyle, and a considerable quantity of the muscle juice and of the serum which soaks the solid parts. Sheep and swine are killed by plunging a long knife from one side of the throat to the other, by which all the great vessels of the neck are divided; the heart, still beating for several minutes, most effectually pumps out all the fluids of the body. The butcher sometimes attempts to run the knife between two bones of the neck, and thus divide the spinal cord; but, as I have determined by examination afterwards, he nearly always fails in this object, and the creature struggles and suffers pain for several minutes till it dies. Sheep are not now knocked on the head, as the appearance of the carcase is thought to be spoiled by that part being crushed, bruised, or stained. Oxen, however, having more power to resist their destroyer, are firmly tied to a stake, and are rendered insensible by being hit on the forehead two or three times with a pole-axe; a long knife is then thrust from the neck obliquely into the chest, and the great vessels are divided as they issue from the heart; blood jets out forcibly for some minutes, and then its flow is further aided by a man standing on the chest, and thus compressing the vessels. About 60 lbs. of blood will flow from a full-sized ox, all of which is allowed to drain into the sewers leading from the slaughter-house, and becomes a nuisance in the neighbourhood by the pestilential vapours it evolves in decomposing.

I had some years ago an opportunity of judging of the injurious effects of these effluvia, for there was a slaughter-house about twenty yards behind a house in Harcourt-street, in which I then resided. It has been since removed by the authorities. It may be calculated, from the data

given in Morton's "Cyclopædia of Agriculture," that about 90,000 tons of blood are in this way wasted annually in England, although its value as manure has been long proved. As is well known, the Jewish nation strive to abstract the blood still more completely. The Rabbi slaughters the animal, which has been previously securely tied, by one great cut, with an extremely sharp knife, across the neck down to the bone. He previously sprinkles a little water upon the animal. The blood jets out for many feet, and the animal struggles and suffers acutely for several minutes. In examining the carcase afterwards, if the slightest adhesion is found between the lung and the chest, it is rejected. The reason of this is probably that the lung would then contain some blood, as it could not entirely collapse. In most cases animals are not fed for many hours before they are slaughtered; for experience had discovered what physiologists have lately explained, namely, that animals pour out nearly twice as much blood if fed. Calves are bled two or three times, with intervals of about twelve hours, before they are killed; and they are thereby rendered so weak that they often faint, or even die, at the second or third bleeding; when, at last, their throat is cut, scarcely any blood issues. The injury this cruel process inflicts on the flesh will be shortly alluded to. Pigs and poultry are still more barbarously treated; for, after the knife is used, they are allowed to run about.

I shall now endeavour to show the propriety of allowing the blood to remain in the animal, distributed throughout the flesh we use; and while I acknowledge that long-established custom seems to have sanctioned the present method of slaughtering, I must remark that many other popular fallacies, which are now seen by every one to be injurious, have only slowly yielded to improvements in scientific knowledge. As will be seen by the analyses of Playfair, blood and flesh are almost exactly identical in elementary composition:—

	Dry Ox Blood.	Dry Ox Flesh.
Carbon,	54·35	54·12
Hydrogen,	7·50	7·89
Nitrogen,	15·76	15·67
Oxygen,	22·39	22·32

and from this fact, Pereira, one of the most reliable writers on diet, allows that their nutritive value is equal. The amount of water each contains is also very similar, namely, 22 per cent. in blood, 20 in flesh. The more important constituents of blood are exhibited in this table:—

Water,	779·20
Hemato-globulin,	141·10
Albumen,	69·50
Fibrin,	2·20
Fat,	1·60
Salts,	5·93
Iron,	0·57
	1000·00

Blood then contains about 70 parts per 1000 of albumen, the model alimentary substance which is presented to us by nature in that typical food the egg, and which, although undeniably superior to the matter which constitutes meat, is wholly drained from it by bleeding. Hemato-globulin, the albuminoid which forms the red cells, exists in the large proportion of 140 per 1000, and this is convertible by the stomach into a substance undistinguishable from that obtained from flesh.

With regard to the other nitrogenized substance, fibrin, it may be objected that it is not susceptible of solution in the weak acid mixture which gastric juice presents; but it would certainly afterwards yield to the alkaline pancreatic juice, which has been lately shown to be concerned in the digestion of some albuminoids. Its small proportion, however, 2 per 1000, renders its consideration unimportant.

It is, however, in the saline matters that meat deprived of blood suffers the most serious loss. The salts of potash abound in flesh, whereas those of soda are almost entirely absent. In blood, on the contrary, there is a large proportion of chloride of sodium, or common salt, and of phosphate of soda—materials of extraordinary value as constituents of human food. This latter salt has been shown by Liebig to fulfil an office essential to the maintenance of life, and which no other salt is capable of performing, namely, the absorption and conveyance of carbonic acid to the lungs, where by exposure to the air it is discharged. That renowned philosopher exclaims:—

"This is again one of the numberless facts which fill with inexpressible admiration the soul of the observer of natural arrangements—namely, that an alkaline phosphate exhibits towards carbonic acid the same comportment as a neutral alkaline corbonate does. Contrary to all known laws, it appears to the chemist like a miracle that two acids—a gaseous one and a fixed one, one of the weakest and one of the strongest, which of all acids differ most in composition—can form with the alkalies found in the blood compounds of the same chemical character. Phosphate of soda has an alkaline taste, and reaction like the carbonate; and its solution in presence of free carbonic acid takes up as much of that acid as the carbonate of soda does, and, like it, only more easily, gives it off, by agitation with air, *in vacuo*, or by evaporation, without losing its power of again absorbing the carbonic acid."

Iron, too, that highly useful, or indeed apparently essential constituent of our body, is drained out with the blood; the sulphates also, which doubtless have some useful, although as yet undetermined, function in the animal economy, exist exclusively in blood. With regard to the potash salts, although they exist in greater proportion in flesh than in blood, there can be little doubt that the last flowing portions of that fluid would rob the solids of a considerable amount. They are, however, much more completely abstracted in the salting of meat, the brine, which is thrown away, containing probably as much valuable material as the tough and scarcely soluble residue. That fearful disease, scurvy, depends on this withdrawal of soluble salts in the curing of meat, as was first demonstrated by Dr. Aldridge, and announced in this room.

Now, I have no doubt that the use of meat in which the blood was retained would prevent this disease; for my former pupil, Dr. David Walker, the naturalist and surgeon to Sir Leopold M'Clintock's Arctic expedition, has informed me that underdone meat, and in which some of the blood remained, was the only sure preventative or restorative. While I am mentioning the injurious effects of the ordinary method of salting meat, I may state that the "Patent Journal" for the 6th of this month announces that provisional protection has been granted to a mode of "preserving from decay human bodies and bodies of other animals; also pickling, curing, and flavouring animal bodies." I am not aware of the nature of this process, but I have grounds for believing that the injection of strong saline solutions through the arteries of the animal would accomplish the object. I take no credit whatever for this surmise; for although familiar for many years with the preservation of anatomical subjects, by a method invented by that most able anatomist, Dr. Alcock, it never occurred to me till I had heard of the application for the patent I have alluded to that the plan might be used in the case of animals which are cured as food. I can see, however, the extraordinary value of such a method, by which the curing of swine could be accomplished with great rapidity, at a mere nominal cost, and without any loss, by the removal of the soluble constituents of the animal, or by the decomposition of the deeper parts of the flesh, which now so often occurs. It would also more effectually destroy the cysticerci, or the animalcules which infest measly pork, and which are capable of developing tape-worm if introduced in a living state into man's body.

Kreatin, that invigorating principle of meat, and other flavouring matters, are also doubtless abstracted from the muscle-juice by the last flowing blood.

I do not know of any principle in the blood of animals which could prove injurious if introduced into the stomach of man; for such effete matters as urea are so completely thrown off by the eliminating organs of the animal, if healthy, that the most expert analyst can scarcely discover them in that fluid. Blood being the source from which all the pabulum of the tissues is supplied, it would seem right that that of other animals should replenish that of man; for the more closely an aliment resembles the substance of the animal which it is destined to feed, the more perfect must it be considered, as the process of digestion and assimilation are then most rapid and simple. However, I would not advocate its use in the separate state; for it would form too fluid an aliment, and would be deficient in a due proportion of non-nitrogenous or heat-producing material. In many country parts of Ireland it is, however, used as human food whenever beasts are killed at home; but the butchers always cast it away. On the continent also the blood is invariably used, in combination with vegetable matters, as food for pigs.

Carnivorous animals also, of course, consume the blood as well as the flesh of the animals on which they prey; and in Magendie's famous experiments it was found that dogs continued to live when fed exclusively on raw meat, which retains some blood; whereas they sank if fed alone

on fibre, albumen, or gelatin. I shall next try to show that the meat from which blood has been abstracted is positively injured. Flesh is of a highly acid reaction, from the lactic acid, of which it contains about 6½ per 1000, and from inosinic, and probably some other acids. In this condition it is unsuitable as human food. Milk and the egg, the two typically perfect animal foods which all-bountiful Nature has provided for all living creatures, are alkaline. To the strongly marked acidity of bled veal its frequent unwholesomeness and indigestibility may be attributed; for Liebig has shown that its ash contains 15 per cent. of phosphoric acid over that which is required to make salts with the alkalies present. It is also composed of a less digestible form of fibre, for it is not soluble in dilute hydrochloric acid. I have found it sometimes to putrefy rapidly, and to have a sour smell. To diminish this acidity, meat requires to be kept some time before being used, or until it becomes alkaline, from incipient decomposition evolving ammonia. Now, it is very hard to determine how far this alkaline putrescence should proceed; and although the gastric juice has undoubtedly antiseptic properties, food may be introduced into the system in a very unfit state. Meat also loses in weight and substance by being kept; and I fear also that, to avoid pecuniary loss, it is often sold and dressed in a condition most injurious, or even poisonous. The blood is an alkaline fluid, and if retained in the flesh would neutralize its acidity, and thus render it fit for food much sooner. The muscles of animals stiffen a few hours after death, which is probably mainly owing to the blood becoming solid within the vessels, for it scarcely occurs in the carcase which has been bled. It is well to wait till this stiffening has disappeared, for the meat is then certainly more tender and digestible.

We eat many animals which are killed by means which leave the blood within them; for instance, hares, rabbits, pheasants, and indeed all game. Venison, too, is often killed without bleeding; and although the animal's throat is in other cases divided after it has been shot, much of its blood is retained, owing to the stoppage of the heart's action. Now, it must be allowed that the flesh of these animals is of the most wholesome and digestible nature—a property which, as well as their delicious flavour, is mainly due to the blood they retain. Fish, too, are killed without losing blood, except perhaps when the cruel plan of crimping is adopted. It has often been remarked that hares caught in snares, and thus strangled, are much less digestible than those shot or hunted. This I would explain by the fact that much blood is lost by being drawn into the lungs and other internal organs while the creature is being suffocated. It has been proved, however, that no method of slaughtering will entirely remove all trace of blood from animals, for the microscope or chemical analysis will still discover it. Any prohibition, therefore, against partaking of blood will be virtually a prohibition against eating flesh at all. As well might Shylock have endeavoured to remove his pound of flesh without bloodshed as might the butcher try to drain absolutely all the blood of the animals he slaughters. Dr. Lankester, one of the best authorities on dietetic questions, and who is

favourable to the principle I am advocating, says—"I have no hesitation in saying that the blood you take away is just as good food as the blood you leave in, and that you would do much better to leave all the blood in the animal."

As is now becoming generally known, a soup of the highest value can be made by digesting meat in cold water to which is added a few drops of hydrochloric acid. I have often witnessed its admirable restorative properties in many debilitating diseases; and they mainly depend on the fact that it contains the soluble constituents of the blood, which are most readily assimilated by persons of even the weakest digestive powers.

The equestrian people of the American pampas and prairies, as well as Europeans who are sojourning there for many months during the hunting season, are well known to live on an exclusively animal diet. The Indians kill the animals they use as food almost always with the bow and arrow, and, as far as I can ascertain, they do not abstract their blood. Indeed, they could not have time to do so before the animals died, for they ride rapidly about through the vast herds of buffaloes. They cut the meat in long strips, which they dry in the sun; and this food, which they call "tajo," confers on them a degree of health and muscular vigour scarcely ever attained by any European race. I am also informed that our troops during the Peninsular War were accustomed to kill their meat by shooting or with the lance, and without any further artistic butchery, and thus obtained food of the finest quality. There are, on the other hand, instances of regiments being decimated by being compelled to live on the flesh of tame cattle slaughtered in the ordinary way.

As regards the modes of slaughtering which would effectually retain the blood in the carcase, I shall first notice that patented by Dr. Carson. The beast is firmly fixed on its back, and tightly bound, so as to prevent struggling as much as possible, and a small cut is made through the skin over the space between the fifth and sixth ribs; this in the sheep may be found about two inches below, and behind, the shoulder joint, and the more easily as the skin is not there covered by wool. Through these cuts there are thrust in two sharp-pointed tubes, with openings at the sides, and to the ends of which are attached bags, containing about a quart of air, which is then forced into the cavities which lie between the lungs and the walls of the chest. The air may be prevented from escaping by the side of the tube by a button, with a concave surface towards the animal, filled with grease or soft putty. The air which is pressed upon the lung exerts still farther force in collapsing the lung when the heat of the body rarefies it. I have also injected water, which, being so incompressible, prevents the expansion of the lungs. The animal almost instantaneously dies, and suffers much less pain than in the ordinary method, which I have previously described. This method so effectually compresses the lungs, heart, and large vessels, that the blood and other fluids remain distributed through the body just as they were during life, whereas these cavities are empty and contracted. This can be tested by making a cut into the neck, when but a spoonful or

two of blood will issue, where very many pounds would if the animal were killed in the usual way; and then, even long after death, lymph, serum, and muscle-juice would drain into the cavity of the chest, as atmospheric pressure does not bear on its outer surface.

Another way, which it strikes me would be even more rapid and painless, would be the injection of a little air into the jugular vein. This, as the surgeon knows from several fatal accidents which have befallen the human subject, kills rapidly by the air mixing with the blood in the right side of the heart, and thus preventing its transmission to the lungs. Horses which are rendered useless by severe accidents are sometimes destroyed by this method. If a large volume of air be forced in by a powerful syringe, death occurs almost instantaneously, and the heart and great vessels will be found contracted. If a narrow knife were inserted between the head and the first bone of the neck, and thrust obliquely upwards, death would also supervene immediately by injury to that part of the brain which anatomists call the "lethal point." A somewhat similar method is adopted, according to Stephens's "Book of the Farm," in the abattoirs of Montmartre, Paris, and in Spain and Germany, namely, dividing the spinal cord with a chisel and hammer between the second and third bones of the neck. These two latter methods are almost entirely painless; but butchers object to them, as they prevent the creatures struggling, and thus forcing out the blood.

I have conversed with several butchers, and practical and observant men, and the principle I have advocated has met with considerable support amongst them. Nearly all allow that meat with the blood retained would be most suitable for making soup, as the colour would be no objection. Many of them have expressed a prejudice against the darker colour of the meat, which would be the case if the animal were strangled; but all the plans I have mentioned are entirely different, for they retain the blood in the tissues, where it remains bright and free from carbon, if the animal be kept from struggling, blood issues from muscle as bright as it enters, if that tissue be kept quiescent. Any dark colour would also disappear as soon as the temperature is raised in cooking to 158°. Others have said that such meat would decompose rapidly; but the fact that hares and other game can be kept longer than most meat seems to contradict this statement, which I think is derived from the fact that blood by itself does, owing to its alkalinity, soon putrefy; but, even if it were true, such an objection has no weight; for the meat in which the blood is retained is much sooner fit for use, and in large institutions it could be consumed shortly after it was slaughtered.

There are many other topics connected with the preparation of flesh meat—as, for instance, the best modes of detecting such as is unfit for human use, from the diseases or parasites from which the animal may have suffered—and the most scientific plans of cooking. But I fear I have already exhausted your patience. On some other occasion I may strive to interest you upon some other subject concerning public health; for although hygienic science has determined many valuable facts and laws, they have not been utilized by diffusion even among the educated public.

[Specimens of the meat in the raw, boiled, roasted, and fried conditions were then exhibited, and were pronounced excellent by all present.]

The Chairman said, that papers of the class to which Dr. Mapother's belonged were most important, and fell peculiarly within the province of that Society, which should not neglect the sanitary interests of the city of Dublin. It was quite unnecessary for him to express his concurrence in the opinion which the meeting, by its applause, had just expressed, on this very interesting paper. He felt sure the large numbers who had assembled to hear the paper of Dr. Mapother were not disappointed in the communication he had laid before them. He concurred in the views taken by him. The present mode of killing animals certainly abstracted a large amount of blood and other nutritious fluids, which were much better left in the body. The old methods of slaughtering were most accurately described in the Pentateuch, and there was no doubt that hygienic considerations influenced Moses in forbidding the use of blood. But the prohibition, most useful in warm climates, was not necessary in colder latitudes.

A Member said the proof of the pudding was the eating, and he wished to know how the meat tasted when cooked.

The Rev. Mr. Wheeler said, in answer to this query, that he had a shoulder of mutton lately dressed, the animal having been killed in the way described, two days before. He could only say that he had never tasted anything so delicious in the shape of mutton in his life.

A Member asked, if an animal were asphyxiated or drowned, could the flesh be used with impunity, which would be most important to know, as great numbers of sheep and cattle were annually drowned.

Dr. Mapother replied, that strangling or drowning was not a very rapid form of death, as it usually occupied about five minutes, and during that time the blood was driven to the lungs in great quantity, but was not freed from carbonic acid. The flesh was consequently very dark, and apt to putrefy; but he thought it could be saved by the method of injection he had alluded to, for in this way the dark blood could be washed out, or could be oxygenated and rendered bright in colour by the injection of saline solutions. Plunging the carcase in hot water would also change the colour from the dark venous to the arterial hue. All the plans of slaughtering he had described were, however, essentially different from suffocation, as the bright red tint of the meat he had exhibited would prove.

XVI.—*Description of a New Species of Plesiosaurus, from the Lias, near Whitby, Yorkshire.* By Alexander Carte, F.L.S., M.R.I.A.; *and* W. H. Baily, F.G.S., F.L.S., *&c.*

[Read on Monday Evening, May 18, 1863.]

The very large and perfect Plesiosaurus which is the subject of the present communication was originally the property of the Marquis of Normanby, on whose estate it was discovered, on the 27th of July, 1848, in the liassic beds which occur at the Kettleness alum works, near Whitby, in Yorkshire; and was presented by his Lordship, as a mark of friendship and esteem, to the late Sir Philip Crampton, Bart., to whose varied scientific attainments it is unnecessary to allude. Before, however, proceeding to describe the specimen, it may be interesting to state that Sir Philip Crampton, with his usual desire for the advancement of science, deposited this magnificent fossil saurian in the Gardens of the

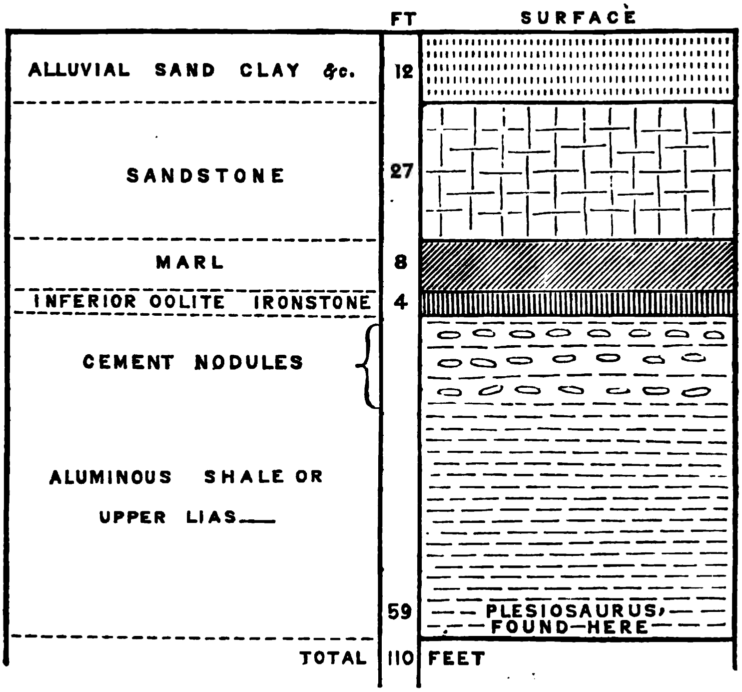
Royal Zoological Society of Ireland, where, having been set up for exhibition in the spring of the year 1853, it was introduced to public notice in a highly interesting lecture, which was delivered by the learned donor himself.

Sir Philip Crampton bequeathed the fossil to the Society above referred to; and owing to the enlightened liberality of the President and Council of that body, who considered that the specimen would contribute more to the public convenience, as well as to general scientific utility, by being placed in a more central locality, it has been deposited in the Natural History Museum of the Royal Dublin Society, where it is now conspicuously placed for inspection and study.

After as careful an examination as possible, and comparison with other specimens, we consider this saurian to be a new species, and have therefore named it *Plesiosaurus Cramptoni*, as a slight tribute to the memory of that eminently scientific man.

We are indebted to the kindness of Mr. J. Kerr, agent to the Marquis of Normanby, for the accompanying detailed section, representing the

ROUGH SECTION OF KETTLENESS WORKS.



succession of beds which characterize the district of Kettleness in which this fossil was found.*

The total length of the skeleton, measured in the line of its vertebræ, is 22 feet 4 inches; its width, 13 feet; it lies in a prone position, resting upon the ventral surface, with the head and neck slightly inclined towards the right side. The skull has been almost entirely freed from the matrix, and is in a very good state of preservation, with the exception of the zygomatic elements being absent on both sides.

The vertebral column has, throughout its entire length, fallen over towards the right side, presenting a slightly irregular curve in the same direction, thus exposing, in the cervical series, a side view of the *centrums* or bodies of the vertebræ, with their large *neurapophyses*, and in some places the remains of the cervical ribs or hatchet-shaped bones.

The centrums of the dorsal vertebræ are almost entirely concealed, but the massive ends of the neurapophyses and pleurapophyses project prominently above the general surface. The caudal portion of the vertebral column is somewhat dislocated and thrown out of its normal position, especially near its junction with the sacral vertebræ; the centrums with their spines and processes are, however, in several parts well exhibited. The ribs spread out on each side of the dorsal vertebræ, those on the left side being nearly in their natural position, and the series most complete.

The pectoral extremities are extended from both sides, on a plane nearly at right angles with the vertebral column,—the left pelvic extremity stretching out in a direction parallel to the pectoral extremity of the same side, while its fellow on the right side inclines backwards more towards the tail; the tarsals, metatarsals, and phalanges of the left hind paddle are deficient, this portion having unfortunately been removed to the calcining kiln before the remainder of the fossil was observed.

Having thus given a general description of this enormous fossil, we now proceed to give a more detailed account, commencing with the skull. This, in contour, is somewhat crocodilian, being what may be called crocodilo-lacertian: viewed from above, its outline is an elongated isosceles triangle, broad posteriorly, and gradually decreasing in width to the muzzle. A profile or side view shows it to be somewhat flattened or depressed, in proportion to its length and width, tapering from the parietal crest to the snout. The length from the anterior extremity of the cranium to the articular end of the tympanic bone is 3 feet 4 inches; from the same point to the end of the articular piece of the lower jaw, 3 feet. The most elevated point is at the parietal crest, and measures in the perpendicular direction to the basi-occipital 13 inches. The breadth from one articular bone to the other is 1 foot 10½ inches, and across the muzzle is about 6 inches.

---

* In the same communication, dated November 21, 1862, Mr. Kerr states that "the large *Ichthyosaurus* last discovered, and which is now in the York Museum, was found a few yards distant, and 15 or 16 feet higher in the alum shale; also another Ichthyosaurus was found, in 1847, near the same place, which was sold to Mr. James Heywood."

The proportional length of the head to that of the neck is as 5 to 8, the head being therefore more than half the length of the neck; its proportion to the total length of the skeleton is about as 1 to 6.

The massive parietal crest spreads out on each side at the posterior extremity of the skull, to unite with the pedicles of the tympanic bones, forming a strong prominent ridge from beneath, and posterior to which proceed the cervical vertebræ. The median portion of this crest is the highest point of the skull, measuring, as before stated, from the basi-occipital, 13 inches.

The zygomatic elements of the temporal bones are, as before observed, broken away on both sides of the skull, exposing the upper surface of the dentary piece of the lower jaw. In consequence of this, the lateral boundaries of the temporal apertures are deficient. These apertures are subquadrate, very large and deep, measuring 13 inches from the superior posterior boundary of the orbit to the parietal crest, and 8 inches transversely from the median portion of this crest to the position occupied by the zygomæ. The magnitude of these spaces indicates, as Professor Owen observes, the great extent of surface afforded for the attachment of the powerful temporal muscles, and "points out in a striking manner the deviation of the *Plesiosaurus* from the crocodilian, and its approximation to the lacertian type of the saurian structure." The inner boundary of these spaces is formed by the median portion of the triradiate parietal, a sharp, prominent, well-defined ridge, extending from the central part of the parietal crest, posteriorly, to the frontals anteriorly, where it gradually becomes less prominent. In this ridge, a little posterior to the anterior boundary of the orbits, is situated a foramen, analogous to that which is present in many genera of the lacertian saurians, and described by the Rev. Lansdowne Guilding, in the *Iguana*, under the name of the *foramen Homianum*. This foramen, in the present instance, occupies a position in the parietal crest a little posterior to the site of the obliterated coronal suture, i. e., about one foot from the parietal crest; its shape is oval, the major axis being $1\frac{1}{4}$ of an inch, and its minor $\frac{5}{8}$ths of an inch. Anterior to this foramen, at the distance of about $6\frac{1}{2}$ inches, there is a slit-like depression in the site of the interfrontal suture, situated immediately posterior to the nasal orifices; it measures in its long axis, which runs in the same direction as the suture, 2 inches, its minor or transverse axis measuring $\frac{5}{8}$ths of an inch, and its greatest depth about half an inch. From the general character and position of this depression, its use would appear to be for the purpose of giving insertion to the condensed fibres of the powerful fascia which bound down the temporal and other muscles of the head, and also in assisting to sustain the weight of the ponderous skull and lower jaw.

The orbits are obliquely placed, are sub-triangular in shape, with the angles rounded off, the posterior external angle being the most acute. They measure in the antero-posterior direction $5\frac{1}{2}$ inches, and the transverse 4 inches.

In the limestone which forms the floor of the temporal apertures

and the orbits are several species of marine shells, such as *Leda ovum*, *Plagiostoma pectenoides*, *Inoceramus dubius*, with fragments of small ammonites—of these fossils the *Leda ovum* is the most numerous.

The nasal apertures are ovoid in shape, and are situated about $\frac{3}{4}$ths of an inch anterior to the orbits, their inner margins being distant $1\frac{1}{4}$ inch on each side of the median line or nasal suture, their boundaries being completed by the convergence of the nasal, anterior frontal, and superior maxillary bones. These orifices measure in the antero-posterior direction 2 inches, and in the transverse 1 inch. From the anterior and broadest part of these apertures a channel or groove runs forwards and outwards to about midway between the orbits and the front of the cranium, in the site of the obliterated intermaxillary suture, where there is a considerable excavation or notch for the reception of the largest tooth in the lower jaw; in this respect offering a close resemblance to a somewhat similar disposition of corresponding parts in the crocodile.

The anterior portion of the cranium is elongated, slightly enlarged, and rounded at the muzzle. The nasal bones are marked by a row of foramina, three on each side of the median (nasal) suture; these foramina are placed parallel to this suture, and at the distance of an inch from each other, their probable use being for the transmission of nerves and vessels to the snout. The premaxillaries are rough and scabrous on the surface; but, although not so strongly marked, are, nevertheless, very analogous to the rugged appearance so characteristic of the crocodile's skull.

The lower jaw is extremely massive, particularly in the direction of its angular and surangular elements. The inferior border presents a strong rounded ridge or *bourrelet*, which extends from the angular piece forwards to the dentary element, where it is gradually lost. This ridge is evidently intended for the insertion of the powerful muscles which moved the lower jaw. The alveolar border of the dentary piece slopes gradually upwards from the symphysis to the coronoid process, from which point it declines again to the articular condyle, thus forming a double inclined plane at an angle of about 150°. The summit of this angle—the coronoid apophysis—is 2 feet 2 inches from the symphysis, and 1 foot 4 inches from the articular condyle; and measuring from the symphysis to the implantation of the largest tooth in the inferior maxilla, the distance is 6 inches. The length of the lower jaw from the symphysis to the centre of the articular cavity, measured along the alveolar border, which forms the sides of this double inclined plane, is 3 feet 6 inches, measured in a straight line along the base of the ramus it is 3 feet $4\frac{1}{2}$ inches; the depth of the lower jaw, taken from the summit of the angle, the *coronoid apophysis*, to its inferior border, is 6 inches, and at the symphysis 3 inches.

The symphysial portion of the dentary element is slightly expanded anteriorly, but not so much so as the homologous part of the premaxillary; consequently, when the jaws are closed, the inferior maxillæ are considerably overlapped by the superior. All the large teeth, six

on each side, are confined to this part of the lower jaw, and do not extend farther back than to the distance of about 7 inches from the symphysis; here they are terminated by the largest tooth of the series, which measures at its base 1 inch in diameter, and is received into a space left between two similar large teeth in the upper jaw, thus forming a most powerful crushing apparatus. The angular piece extends backwards for about 5 inches behind the articular condyle; it is very robust, with its free extremity turned upwards and inwards.*

The teeth resemble those of the crocodile in their irregular mode of arrangement, and in being implanted into distinct alveolar cavities. They are much mutilated, especially the large ones, in front of the cranium.

The total number is from 100 to 120, that is, from 25 to 30 in each jaw on both sides; of these 11 large teeth occupy a space of 16 inches in the pre- and superior maxillary bones, the last or most posterior of these large teeth being situated immediately beneath the anterior external angle of the orbit. From this to the implantation of the most posterior tooth of the series, which is situated about six inches behind and one inch beneath the posterior external angle of the orbit, there are twenty teeth in the space of twelve inches. In the lower jaw, as before stated, the large teeth are confined to its symphysial portion, or to a space of about seven inches on each side measured from the symphysis. The strongest of these teeth is the last, or that which is implanted into the inferior maxilla a short distance in front of the excavation in the upper jaw corresponding to the site of the maxillo-premaxillary suture. This tooth measures at its base one inch in diameter, and is received into a space left between two similar large teeth in the upper jaw. The large teeth are, unfortunately, so broken that it is impossible to give their lengths.

The smaller teeth commence immediately behind the large ones, and gradually decrease in size to the last of the series, which is implanted into the lower jaw at a point corresponding to the insertion of the most posterior tooth in the upper series, that is, about six inches behind and one inch beneath the posterior external angle of the orbit: measuring from the large tooth, the distance is thirteen inches and a half; into this space from 16 to 20 teeth are inserted. The smaller teeth are in a good state of preservation, and exhibit longitudinal striæ on their enamel surface.

THE CERVICAL REGION.—The atlas and axis are so blended with the matrix, that it is impossible to give any special description of either of these elements. The remainder of the vertebræ composing this series are extremely robust, and, including the atlas and axis, are 27 in number; the length of the neck, measuring from the back of the skull to

* The remarkable angular conformation of the jaws in this specimen, combined with its peculiar arrangement of teeth, would doubtless offer great facility in the capture and destruction of the particular food upon which this animal preyed.

the last cervical vertebra, is six feet. The neck is, therefore, about twice the length of the head.

The bodies of the vertebræ exhibit on each of them the elliptical costal pits, as described by Professor Owen; these pits are divided by a well-marked horizontal fissure into two articular facets, an upper and a lower; and as the vertebræ approach the dorsal region, the upper of these facets increases gradually in size at the expense of the lower, until at the 27th it forms the entire articulation for the pleurapophyses, or hatchet shaped bones, and has therefore been conventionally assumed to be the termination of the cervical region. The centrum of the 27th or last cervical measures five inches in its transverse, and four inches in its antero-posterior diameter; the depth of its articular cavity is $\frac{5}{8}$ths of an inch.

THE DORSAL REGION.—The centrums or bodies of the vertebræ composing this region, which are lying on their sides, are almost entirely concealed in the matrix; but their massive neural spines, with their rounded free extremities, and the transverse processes, project prominently above the general surface. The number of vertebræ entering into the composition of this series, reckoning from that vertebra on which the costal surface begins to be sustained on a diapophysis, and therefore arbitrarily held to be the first dorsal, to the sacral or that vertebra upon which the transverse process subsides to the level of the neurapophyses, are 30, its length being 8 feet.

THE CAUDAL REGION.—This portion of the vertebral column has suffered most from displacement, especially near its junction with the sacral region; however, beyond this, and towards its central portion, the centrums or bodies are easily recognisable, together with their pleurapophyses and short and straight hæmapophyses. Two of the vertebræ give the following measurements:—The body or centrum of the seventh from the sacrum measures 4 inches in the transverse, and 2 inches in the antero-posterior diameter; and the 34th or terminal vertebra preserved in this skeleton measures $1\frac{7}{8}$ inch in the tranverse, and $1\frac{1}{8}$ antero-posterior diameter. The entire number of vertebræ entering into the formation of this region is 34; and its length is 5 feet 6 inches, or about one fourth of the entire length of the fossil.

THE COSTAL REGION.—The ribs are well exhibited, being but slightly removed from their original position. There are 30 on the left, and only 22 remain on the right side. The length of the ninth, measured along its curve, is 3 feet; the breadth of its flattened portion near its articular or vertebral extremity is $1\frac{3}{4}$ inch; at the roundest part, near its free end, it is $1\frac{1}{4}$ inch; and at its expanded free termination it is 2 inches. From the position in which the fossil is lying, the sternocostal arcs are not discernible.

THE PECTORAL ARCH.—The elements composing this portion of the skeleton are so mutilated that it is impossible to give an accurate de-

scription of them, the only part sufficiently preserved being the thick articular end of the left scapula, forming the glenoid cavity, which measures in its major 5½, and in its minor axis 4½ inches.

THE PECTORAL EXTREMITY.—The humerus is a large and strong bone, rounded and thick at its proximal or scapular end, the head, and flattened out at its distal extremity, where it is very indistinctly divided into two surfaces for the articulation of the radius and ulna. The shaft has a considerable curve posteriorly; it measures in length 1 foot 8 inches, and in breadth across the distal or radial extremity 8 inches.

The radius and ulna are both comparatively short and flat bones; the former is nearly straight, and measures 6 inches in length, by 4 in breadth; the latter is curved towards the former, and measures 5½ inches long, by 5 wide.

The arrangement of the smaller bones, as made out from the two anterior extremities, appears to be the following:—The carpal bones, six in number, are arranged in a double row of three in each; they resemble those of the other species in being flattened ossicles, with an outline more or less rounded.

The metacarpals, of which there are only four, are elongated and slightly enlarged at both ends; these are followed by three rows of phalanges, having, like the metacarpals, only four ossicles in each row; then follow one row of three digits, two rows of two digits, and, lastly, a terminal one.

The entire length of the anterior extremity, measuring from the head of the humerus to the extremity of the terminal digit, is 5 feet.

THE PELVIC ARCH.—This, like the pectoral, is greatly mutilated; the only element which can be identified is the iliac bone. This is short and strong; its body is somewhat flattened and constricted in the centre of its length, expanded at its junction with the sacral vertebræ, and rounded where it coalesces with the pubis and ischium to form the acetabulum. The length of the iliac bone is 10 inches; its flattened vertebral end is 5 inches wide; and its rounded or acetabular extremity measures in its major 4½ inches, and in its minor axis 3¾ inches.

THE PELVIC EXTREMITY.—The femur corresponds nearly in size and shape with the humerus, its chief difference being in the greater breadth of its flattened or tibial extremity. In length it is 1 foot 8½ inches, and 9½ inches in breadth across its distal or tibio-fibular articulation.

The tibia and fibula are also proportionately larger than the radius and ulna; the length of the former is 7 inches, its breadth being 6 inches; the latter bone, which is curved like the ulna, measures 6 inches in each direction.

The tarsal bones are six in number, the first row corresponding very much in size and shape with the first row of carpals. The second row is, however, larger in size, and more circular in outline than the second row of carpals.

The metatarsals are, as in the anterior paddles, but four in number, and similarly expanded at their extremities. They are succeeded by two rows of phalanges with 3 ossicles in each row, then follows one row of 2 ossicles, and finally a single digit, which completes the series.

In all the four paddles the digits are more or less elongated, and shaped somewhat like an hour glass, that is, constricted in the middle of their lengths, they are also very nearly equal in size; but the digits of the posterior extremities are generally a little more lengthened than those of the anterior.

The peculiarity which prevails in all the paddles of the skeleton, that of a departure from the typical numbers of five metacarpals and metatarsal bones with their corresponding phalanges, there being but 4 ossicles in each, appears so anomalous, that we believe it can scarcely be relied upon as a distinguishing character, as, in consequence of their being imbedded in friable shale, it is very possible that they may have got misplaced in setting up the fossil.

On comparing this species with those already known, it seems to bear the nearest approach in specific characters to a fine specimen from the same locality, at present in the museum of the Yorkshire Philosophical Society, which has been named *Plesiosaurus Zetlandicus* by Professor Phillips, and which is as yet, we believe, undescribed. On visiting that Museum, however, for the purpose of examination and comparison, in which we were obligingly assisted by the curator, Mr. W. S. Dallas, it was found to differ in the following very important particulars:— In the relative proportions of the head, which in *P. Cramptoni* is much broader posteriorly than that of *P. Zetlandicus*, the orbits in the latter being of greater proportionate diameter, notwithstanding which their anterior margin is considerably more distant from the posterior boundary of the nostrils; the depth of the skull is also much less in the latter species.

On reference to the accompanying Table of measurements, another striking difference will be observed between these fossils, namely, that although *P. Zetlandicus* is a smaller specimen, the principal bones entering into the formation of its extremities are actually larger than the corresponding parts in *P. Cramptoni*.

There is another *Plesiosaurus* in the Whitby Museum, named *P. macrocephalus*,* from the same locality and formation; but not having an opportunity of examining this fossil ourselves, we are indebted to the kindness of Mr. Martin Simpson, the able curator of that museum, for its measurements, which are included in the following Table. By reference to these, it will be seen that the cranium of this specimen has a much greater breadth, in proportion to its length, than that of the

* Mr. Simpson expresses considerable doubt as to the correctness of the identification of this specimen with *P. macrocephalus*; and from the description and measurements which he has obligingly furnished us with, we agree with him that it may have been incorrectly referred to that species.

cranium of *P. Cramptoni*; the dorsal region in *P. Cramptoni* is also proportionately much longer than the corresponding part of the skeleton in *P. macrocephalus*. We are, therefore, inclined to consider these two fossils as specifically distinct from that we have just described.

COMPARATIVE MEASUREMENTS OF PLESIOSAURI.

	P. Zetlandicus, York Museum.		P. Macrocephalus? Whitby Museum.		P. Cramptoni, Dublin Museum.	
	Ft.	In.	Ft.	In.	Ft.	In.
Total length of the skeleton, ...	19	0	14	10	22	4
Length of skull from angle of lower jaw to the point of the snout, ...	8	6	2	$3\frac{1}{2}$	3	10
" from the tympanic articulation to the point of the snout, ...	3	0	0	0	3	$6\frac{1}{2}$
" of the skull, measured from snout to parietal crest, ...	2	5	2	0	2	10
" of the lower jaw, ...	0	0	0	0	3	9
" from the tympanic articulation to the posterior external angle of orbit, ...	1	$4\frac{1}{2}$	0	0	1	9
" to the implantation of the last tooth, ...	0	0	0	0	1	4
Shortest distance between anterior margin of orbit and nostril, ...	0	$1\frac{5}{8}$	0	$\frac{3}{8}$	0	$\frac{1}{2}$
Breadth of the skull from one tympanic articulation to the other, ...	1	4	1	3	1	$10\frac{1}{2}$
" " across the orbits, ...	0	0	0	10	1	8
" " from one infraorbital ridge to the other, ...	0	9	0	0	1	0
" " across external nostrils, ...	0	9	0	11	0	$11\frac{1}{2}$
" " across the snout, ...	0	$4\frac{1}{2}$	0	$3\frac{1}{2}$	0	6
Longest diameter of upper temporal aperture, ...	0	11	0	0	1	$1\frac{1}{2}$
Depth of skull at its posterior part from the basioccipital to the top of parietal crest, ...	0	8	0	0	1	1
" " at the snout, ...	0	4	0	8	0	5
Length of the cervical vertebræ, ...	4	4	4	2	6	0
" " dorsal "	6	1	4	8	8	0
" " caudal "	6	2	4	0	5	6
" " humerus, ...	1	8	1	$1\frac{1}{2}$	1	9
Breadth of radial or distal end of humerus, ...	0	$9\frac{1}{2}$	0	6	0	10
Length of radius, ...	0	7	0	$4\frac{1}{2}$	0	6
Breadth of ditto at proximal or humeral end, ...	0	5	0	$3\frac{3}{4}$	0	5
Length of the ulna, ...	0	6	0	$4\frac{1}{2}$	0	$6\frac{1}{2}$
Breadth of do., ...	0	$4\frac{1}{2}$	0	$3\frac{3}{4}$	0	$4\frac{1}{2}$
Length of the femur, ...	1	9	1	$2\frac{1}{4}$	1	10
Breadth of do. at tibial or distal end, ...	0	$8\frac{3}{4}$	0	$6\frac{1}{2}$	0	$10\frac{1}{4}$
Length of the tibia, ...	0	$6\frac{1}{2}$	0	0	0	$6\frac{1}{2}$
Breadth of do. at proximal end, ...	0	5	0	0	0	$5\frac{1}{4}$
Length of the fibula, ...	0	0	0	0	0	6
Breadth of do. at proximal end, ...	0	0	0	0	0	6

COMPARATIVE NUMBERS OF VERTEBRÆ.

	P. Zetlandicus, York Museum.	P. Macrocephalus? Whitby Museum.	P. Cramptoni, Dublin Museum.
Number of vertebræ in the neck, ...	26?*	28?	27?
Do. do. dorsal and lumbar, . . .	29?†	30?	30
Do. do. sacral and caudal, ...	41	37?	34?
	96	95	91

EXPLANATION OF THE PLATES.

Plate I.—*Plesiosaurus Cramptoni*, reduced to a scale of $\frac{6}{10}$ths of an inch to the foot.

Plate II., Fig. 1.—Upper view of cranium, $\frac{1}{6}$th of the natural size.

,, Fig. 2.—View of the left side of cranium and lower jaw, $\frac{1}{6}$th of natural size.

,, Fig. 3.—One of the large anterior teeth, broken obliquely, showing pulp cavity; natural size.

,, Fig. 4.—One of the smaller posterior teeth, showing longitudinally striated surface; natural size.

,, Fig. 5.—View of the posterior surface of 27th or last cervical vertebra; reduced to half the natural size.

XVII.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

THE AUTHOR.

Hansteen (Pr.). Magnetiske Jagttagelser paa Island og Spitzbergen. [pp. 15]. 8vo. *s. l., s. a.*

THE AUTHOR.

Jones (Joseph, Esq. . . .). Improved System of Ventilating Coal Mines. . . . 8vo. *Manchester*, 1854

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.

Kirwan (William Bourke . . . .). Defence of . . . . ., Opinion of Alfred S. *Taylor*, M. D., . . . "that no Murder was committed." 8vo. *Dublin*, 1853

---

* Probably more are concealed behind the head.

† Perhaps another lumbar vertebra may be contained in the mass in which the four first caudal vertebræ are included.

THE PUBLISHER, MR. ROBERT HARDWICKE, 192, PICCADILLY.

Lawson (Henry, M. D., . . .). A Manual of Popular Physiology : . . . . the Science of Life in untechnical Language.
8vo. *London, s. a.* [1863]

THE AUTHOR.

Leared (Arthur, M.D., M. R. I. A.). Infant Mortality and its Causes. . . . [pp. 13]. 8vo. *London,* 1863

THE AUTHOR.

Locke (John, ...). Remarkable Discoveries in Central Australia. [pp. 13]. 8vo. *Dublin,* 1863

THE AUTHOR.

Pike (William Patrickson, Solicitor). Form of a Fee-farm Grant, under the Renewable Leasehold Conversion Act, and of Memorial; Table of Yearly Value of Fines . . . [pp. 24]. Second Edition.
8vo. *Dublin,* 1863

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.

Proceedings at the Election for . . . . Dublin . . . . January . . . 1835; Candidates:—O'Connell, ... Ruthven, ... West, ... Hamilton. 8vo. *Dublin,* 1835

THE CONSUL OF THE UNITED STATES OF AMERICA.

Report of the Commissioners of Patents for the Year 1861. Agriculture. 8vo. *Washington,* 1862

THE ROYAL IRISH ACADEMY.

Siegfried (Rudolph Thomas, Dr. Phil. . . .). On the Gaulish Inscription of Poictiers: containing a Charm against the Demon Dontaurios. Arranged by Carl Friedrick *Lottner* . . . [pp. 20].
8vo. *Dublin,* 1863

THE AMERICAN PHILOSOPHICAL SOCIETY, PHILADELPHIA.

Transactions of the American Philosophical Society, held at Philadelphia, ... Vol. XII.—New Series. Part III.
4to. *Philadelphia,* 1863

THE AUTHOR.

Whately (Richard, D. D., Archbishop of Dublin). Condition of a Church Militant. A Charge . . . . at the Annual Visitation of the Diocese of Dublin, ... 16th June, 1863.
8vo. *London,* . . . . *Dublin,* 1863

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.

Wynne (the Rev. Richard, A. B.). Sermon . . . . on the Death of the Rev. Thomas Butler, A. B., ... of Clongil and . . . . . Ardbraccan, ... assassinated . . . . 24th October, 1793.
8vo. *Dublin,* 1793

(Signed) EDW. RICHARDS PUREFOY COLLES,
Librarian.

June 30, 1863.

BOTANIC GARDEN.

C. E. Bagot, Esq., M. R. D. S., 4, *Upper Leeson-street*:—Root of Sarsaparilla, for Museum.

E. Otto, Esq., M. R. D. S., *Inspector, Botanic Garden, Hamburgh*:—82 parcels of Seeds.

M. Van Houtte, Cor. M. R. D. S., *Nurseryman, &c., Ghent, Belgium*:—117 parcels of rare and valuable Seeds.

Ditto:—30 rare and valuable Plants.

Mr. Dean, *Nurseryman, Bradford*:—12 rare Plants, and 18 kinds of Pansies.

N. Moe, Esq., *Inspector, Botanic Garden, Christiania, Norway*:—50 packages of rare plant Seeds.

M. Ortgies, Cor. M. R. D. S., *Botanic Garden, Zurich*:—50 parcels of plant Seeds.

From the Botanic Garden, Melbourne, *through* Dr. Harvey, *Trinity College, Dublin*:—145 kinds of Seeds.

Miss Bunbury, *Picton, Bunbury, Western Australia*:—Seeds of the Wooden Pear Plant (*Xylomelum pyriforme*).

Ditto:—Parcel of Seeds from Australia.

E. Senior, Esq., M. R. D. S., *Ashtown, Phœnix Park*:—30 packages of Seeds from Victoria.

E. Cane, Esq., M. R. D. S., *Constabulary Office, Dublin Castle*:—Package of African Seeds.

Dr. Haughton, M. R. D. S.:—Branch of tree with large excrescence, for Museum.

Dr. Harvey, M. R. D. S., *Professor of Botany, Royal Dublin Society, &c.*—6 kinds of Seeds from Ceylon.

Ditto:—6 kinds of Seeds from Caffraria.

N. M. Priaulx, Esq., *Southampton*:—3 plants of Melocactus from the West Indies.

J. K. Lenton, Esq., *late of her Majesty's Royal Indian Navy*:—10 parcels of Indian Seeds.

Mr. Veitch, *Royal Exotic Nursery, King's-road, Chelsea*:—12 very valuable Plants.

Mr. Tyerman, *Director of the Botanic Garden, Liverpool*:—50 rare exotic Plants, including 3 large Palms (*very valuable*).

Mrs. Acheson Lyle, *Oak Lodge, Londonderry*:—9 kinds of Seeds from New Zealand.

His Grace the Archbishop of Dublin:—11 kinds of Indian Seeds.

MR. ANDERSON, *Nursery and Seedsman, Perth* :—20 species of rare Plants.

MISS CROZIER, 19, *Lower Dominick-street* :—38 kinds of Seeds from the Mauritius.

MISS WIERS, *Upper Gardiner-street* :—6 kinds of Seeds.

MRS. ROWLEY, *Kells* :—40 kinds of Seeds from Australia.

MR. FRAZER, *Nurseryman, &c., Comley Bank, Edinburgh* :—30 species of rare and valuable Plants.

MR. STARK, *Nursery and Seedsman, Glen Nursery, Dean Bridge, Edinburgh* :—15 species of rare Plants.

A. A. DUNLOP, Esq., M. R. D. S., 95, *Baggot-street* :—Parcel of Seeds of Indigo Plant.

REV. E. CRAWFORD, *Drumcliffe Glebe, Co. Sligo* :—2 parcels of Australian Seeds.

W. H. BAILY, Esq., *Geological Survey, Stephen's-green* :—3 papers of rare Seeds from New Zealand.

MISS WEBB, *Winslow Terrace, Rathgar* :—23 packets of rare Australian Seeds.

DITTO :—Parcel of Cape Bulbs.

W. E. HAMILTON, Esq., *Observatory, Dunsink* :—Fine specimens of Wood of *Robinia pseudacacia*, for Museum.

J. LONGFIELD, Esq., M. R. D. S., *Harcourt-street* :—2 kinds of Indian Seeds.

ROBERT CALLWELL, Esq., M. R. D. S., 25, *Herbert-terrace* :—Seeds of Assam Tea Plant.

M. WENDLAND, *Inspector, Botanic Garden, Herrenhausen, Hanover* :—16 species of very rare and valuable Plants.

SIMON FOOT, Esq., M. R. D. S. :—1 Double Orchis.

CAPTAIN MEADOWS TAYLOR, *Harold's-cross* :—12 kinds of Indian Seeds.

June, 1863. (Signed) D. MOORE, *Curator*.

NATURAL HISTORY MUSEUM.

HENRY VEREKER BINDON, M. D., *Old Leighlin Glebe, Leighlin Bridge* :—Rock specimens from China.

ARTHUR MITCHELL, M. D., F. R. C. S. I., M R. D. S., 118, *Stephen's-green, W.* :—The Tongue of a Toucan.

EDWARD QUIN, Esq., 4, *St. Patrick's-terrace, Rathgar* :—A Burmese Box from Rangoon.

DR. ANDERBERG APOTHEKET, *Ugglan, Stockholm* :—A collection of the rare Minerals found near that city, named by himself.

E. Henry, Esq., *Littleton, Stillorgan*:—A collection of specimens illustrating the process of Lead Smelting.

Robert Reeves, Esq.:—3 specimens of the *Astacus pellucidus*, and 1 specimen of the *Amblyopsis spelæus* (or Blind Fish) from the cave of Kentucky.

Rev. James M'Neece, *Arboe, Stewartstown*:—10 specimens of Pollan (*Coregonus pollan*), from Lough Neagh.

Frederick J. Foot, Esq., Geological Survey, *Athlone*:—6 specimens of Pollan (*Coregonus pollan*), from Lough Rea.

Lieut. David Seymour, 12th Regt., Brisbane, Queensland, per Major Seymour, *Ballymore Castle, Ballinasloe*:—An Emu's Skin (*Dromaius novæ Hollandiæ*) from Queensland.

Rev. James Digges La Touche, *Stokesay, Salop*:—A collection of Silurian Fossils from the neighbourhood of Ludlow.

Lieut. John Lewis Riall, 15th Regt., Malta, per Phineas Riall, Esq., *Old Conna Hill, Co. Dublin*:—A collection of Marine Birds from the Southern Ocean, also a few Birds from Malta.

(Signed) Alexander Carte, M. D., *Director*.

June 18, 1863.

FINE ARTS.

Lord Talbot de Malahide, V. P. R. D. S., *The Castle, Malahide*:—Specimens of ancient Fictile Ware from Corinth.

Ditto:—Lithographic Portrait of Lord Talbot de Malahide.

Henry Vaughan, Esq., 28, *Cumberland-terrace, Regent's-park, London*:—The following collection of Photographs, framed:—

Carving in walnut wood in the Instituto delli Bella Arti, Sienna, by Antonio Barili. 1453—1516.

Ditto.

Frame in walnut wood in the Casa Malavolti, Sienna, by Antonio Barili. 1453—1516.

Frame in walnut wood, by Antonio Barili, of Sienna. 1453—1516. Size of original 33 × 23½ inches. Negative at Kensington Museum.

Panels in oak, Flemish. 16th century. Negative at Kensington Museum.

Carving in ebony, Raffaelle Vespynani, Rome, 1862. Negative at Kensington Museum.

Designs by Stothard for border of silver, executed in silver for Geo. IV. Negative at Kensington Museum.

From drawing by Flaxman, design for silver. Negative with Mr. Hogarth, London.

From drawing by Stothard of Flaxman's Achilles' Shield. Negative by Mr. Hogarth, London.

Panels carved in walnut wood. Size of originals 23 × 9½ inches each.

Bas-relief in white marble, by Donatello, or his school. 1383—1466. Negative with Mr. T. Thompson, Kensington.

Carvings removed from house built in 1703. Negative at Kensington Museum.

Venetian Gilt Frame, 1 inch less than original. Negative at Kensington Museum.

Panels carved in walnut, size of originals 15 × 13½ inches each. Negative at Kensington Museum.

Panel in oak, Louis XVI. Negative with Mr. Thompson, Kensington Museum.

June, 1863.

INTELLIGENCE.

SPRING CATTLE SHOW, 1863.

Meeting for the Announcement of Prizes.

The Meeting for the announcement of Prizes awarded at the Annual Spring Cattle Show of the Royal Dublin Society, which took place on the 7th, 8th, and 9th April, was held on the evening of Wednesday, April 8.

The arrangements for the accommodation of stock and implements were, in consequence of the erection of a large extent of permanent shedding, more complete than at any previous Show; while the weather, which on many similar occasions was so unpropitious, was unusually fine.

The following is the number of entries of each description of stock, poultry, and implements:—

Bulls, (Short-Horned), ...	167	
„ (other breeds), ...	28	195
Cows and Heifers, (Short-Horned), .	44	
„ (other breeds), ...	76	120
Fat Cattle, ...		56
Sheep, (lots), ...		40
Swine, (lots), ...		44
Horses, ...		16
Poultry, (lots), ...		149
Implements, Machines, &c. (lots), .		68

The Meeting was held in the Lecture Theatre, where the visitors who had been invited to be present, and Members, were assembled. There was a very full attendance, the Theatre being crowded to excess. His Excellency the Earl of Carlisle arrived at a quarter past nine o'clock, accompanied by his staff, and took the Chair as President of the Society.

Mr. George Woods Maunsell, Secretary, then addressed his Excellency, and said that, in introducing the show of 1863 of this Society, founded for the promotion of industry as well as other useful arts, the Society had nothing to lay to its charge in the shape of shortcomings or failure in the many exhibitions which had taken place on their

premises. At this show they had not quite so many cattle as on former occasions; but he believed it was the opinion, not only of the Judges, but of the great body of experienced agriculturists, that they had witnessed an exhibition whose deficiency in numbers was made up by the extraordinary perfection of the animals exhibited. There was some falling off in the number of yearling bulls, but there never had stood in the halls of the Society a body of animals so calculated to improve the species. If they took the classes that were somewhat advanced in age, he believed the perfection was not the less acknowledged; and though Colonel Towneley had carried off worthily, and not for the first time, the first prize in the yard, it was well known to everybody that it was after one of the most critical struggles for superiority which the successful exhibiters had ever to go through. He (Mr. Maunsell) might venture to say that, in winning the blue ribbon, he had performed a more difficult feat than when he won the blue ribbon of the turf some years ago on the Downs of Epsom; and in giving him all the credit which a skilful agriculturist was entitled to, it was only fair to say, at the same time, on behalf of Irish exhibiters, that though Colonel Towneley's stock was second to none in the United Kingdom, and he was supposed to have sent to the exhibition those cattle he had looked upon as the first of their class, in three other classes the Irish agriculturists were able to meet him, and to beat him, and that in the persons of Mr. Ball, Mr. Welstead, and the Marquis of Waterford; and that he found competitors in the different classes that were able to exhibit animals that were adjudged, by the most competent judges, to be superior to those which he (Colonel Towneley) had brought from England. It was somewhat curious, in looking to the number of prizes that had been awarded, to consider the importance of these shows as regarded the breeding of stock, and to see how diversified were the localities to which these premiums were awarded. They had, amongst the highest order of prize animals, a short-horn, from the county of Kerry. He had occasion to allude on a former occasion to the fact of the short-horns having invaded Kerry. Waterford carried off no less than five of the highest prizes. Limerick, scarcely less distinguished, had won three. Dublin, which stood last year first, was content with two prizes; Monaghan was the winner of one prize; Lancashire was the winner of no less than three prizes; Tipperary, which was next to Lancashire, and had fought no unworthy contest with the winner of the day, had won one prize; Wicklow one; and Cork one, In miscellaneous breeds, the metropolitan county had distinguished itself far above all others, as Dublin had carried off fifteen prizes, and Meath four. He had no doubt that every one present would hear with pride and pleasure that the venerable Earl of Charlemont, full of years, had carried off no less than five prizes. Passing from these animals, and going on to the fat stock, he thought he might anticipate the opinion of the meeting as to the locality from which the prize cattle in this class were likely to come. Meath was first in fat cattle, and had carried off no less than thirteen prizes. The next in order was Kildare, and it was obliged to be content with four. He did not think it escaped the attention of gentlemen entering the hall, to observe the extraordinary beauty of one of the heifers—the Maid of Moylane—an animal so beautiful, that its superior had never been in the hall. In some respects they did not hold their show at exactly the period of the year which was calculated to bring forth the best specimens of sheep. The month of April was not the time when men would go to look for sheep for breeding purposes. Notwithstanding that, he thought the sheep exhibited had attained a degree of perfection which had not been surpassed at any former show. He knew it was the intention of the Royal Agricultural Society to hold the show in the autumn, when sheep would be more perfect than at this period. The show of pigs was equal to anything they had before. Among the successful exhibiters they had the Marquis of Waterford, Lord Clermont, Lord Lurgan, and others. He was glad to see that the breeding of pigs in this country was receiving increased attention; and he would venture to hope that those gentlemen who were exhibiters would be imitated by many others, and that the pig, which was more particularly the poor man's live stock, would continue to meet all the attention which an animal so important in agriculture required. Turning to farming implements, no man could walk through the yard without feeling how rapid had been the strides with which farming implements had progressed in this country. If they looked back twenty-two years ago, when the threshing machine was first exhibited, and contemplated the variety of implements now exhibited at the show, they could not but think that the struggle which

was going on to introduce capital into agriculture would derive no small impetus from the introduction of agricultural machinery, which tended to cheapen cost and enable farmers to carry on operations far more readily than formerly. It was curious to look back and see how rapid had been the change with regard to tillage farming, and on this subject the speaker entered in detail into the discoveries which had been made in the matter of artificial manures. In conclusion, referring to the exertions of his Excellency to promote the cause of agriculture in Ireland, the speaker said that he could not but think that if his Excellency's ancestor, Belted Will, could rise in his castle of Newark, and come here and find his Excellency in the halls of the Geraldines, distributing prizes of industry among the representatives of the Palatines of Lancashire and the Desmonds, he would marvel at the changes which had come over the land.

Dr. Steele, Assistant Secretary, having read the List of Prizes awarded by the Judges, then made the following statement:—

Having now, may it please your Excellency, submitted a list of the Prizes awarded at the thirty-second Annual Spring Cattle Show, may I venture to trespass upon your Excellency's indulgence and that of this Meeting for a short time, while, in accordance with the wish of the Committee of Agriculture, I survey, as briefly as the subject will permit, the progress of the Agricultural Department of our Institution.

The primary object of the Society's incorporation was the promotion of Husbandry; but as, in course of time, another society,—whose exclusive object was the holding of Agricultural Exhibitions, and for which it received an annual grant from Parliament,—arose, the efforts of this body were for a time directed into channels of utility otherwise unprovided for.

When, however, the Government withdrew its support from the Farming Society, the Royal Dublin Society resolved to endeavour to supply its place. But a large sum being then due for the purchase of these extensive premises, and a serious and unexpected reduction of the Parliamentary grant having then occurred, prevented it from acting as vigorously in the matter as it wished to do.

In 1830 the Society passed a Resolution to the following effect:—

"That an Exhibition of Live Stock, with the view of promoting an improvement in the Breed, be held in the yard adjoining this House, at such time in the next year, under such regulations, and at such an expense for premiums and other charges, as the Society may subsequently direct and appoint; and that it be referred to the Committee of Agriculture and Planting to submit to the Society, at their earliest convenience, a plan for carrying the same into effect."

The Exhibition was accordingly held on the 26th and 27th April, 1831, which consisted of 13 Bulls, 7 Cows, 9 Heifers, 22 Fat Oxen, Cows, and Heifers; 8 Sheep, 6 Horses, 2 Spanish Asses.

On this Show the Committee reported that "they feel justified in congratulating the Society on their having given this stimulus to national improvement. They feel satisfaction in stating that the funds which the Society thought proper to place at their disposal exceeded, a good deal, the actual expense. The amount of the premiums offered, and for which competitors appeared, scarcely exceeds £100, while the contingent expenses were within the sum of £50. On the other hand, the receipts for admission produced a sum of £41, which leaves a sum of about £110 as the actual outlay attending the Exhibition, which the Committee are sanguine enough to think has laid the foundation for much useful improvement."

Two years after, the Committee of Agriculture, adverting to the approval by the country at large of the efforts of the Society in this particular, submitted a plan for the further "promotion of Husbandry in Ireland:—

"1. By the collection and diffusion of agricultural knowledge.

"2. By exciting and sustaining the zeal of local Societies.

"3. By collecting, and opening for public inspection, a Museum of Agriculture.

"4. By electing a Professor of Agriculture, whose office shall be to assist in carrying out the foregoing objects, and to deliver lectures upon the various subjects connected with Agriculture and Planting."

In the course of the observations which follow it will be seen how steadily, and with what success, the Society has endeavoured to carry out the objects thus stated.

The Shows appeared not to have been more extensive than they were at first for some few years; but in 1838 a marked improvement is recorded. The Committee report in that year "that the advantage derived from the annual Exhibitions of Cattle and Stock of all descriptions has never been so decidedly proved as in the present year; the number of Black Cattle entered for the Show which has thus terminated has nearly doubled that of any former year, and has fully occupied all the space which their extensive Cattle Yard afforded. Forty-two Bulls have been exhibited this year, twenty last year. But it is not on the number of Beasts exhibited that the Committee are disposed to dwell. The quality of the Stock has been the universal theme of approbation during the two days the Show has lasted; and the Judges of the Breeding Stock felt it right to make a special report to the Committee, that in that particular class of cattle—the most important to the country—they have observed with much satisfaction the decided improvement which has taken place in the different lots submitted to their judgment at the present Show."

The Committee, in reporting on the Spring Show of the following year, testify as to its increase in extent, and the improvement in the breeds of cattle which were manifested. The remarkable features of this Exhibition were, however, the first appearance of English gentlemen in the capacity of Judges, and the offering of money premiums, honorary rewards having been given exclusively at previous Shows. The Committee stated "that John Berrot, Esq., of Berwickshire, and J. C. Maynard, Esq., of Yorkshire, who attended in that capacity, expressed the satisfaction they felt at witnessing so excellent an Exhibition of Cattle, particularly in the Short-horned Breed, and stated that they never attended a superior Show but once, and that in the county of York. Mr. Maynard gave the strongest proof of his opinion by purchasing, at a very large price, a short-horned bull calf from Robert Holmes, Esq., to take to England to improve his own stock, of which he is a considerable proprietor."

The admissions to Show amounted in this year to £117 13*s*.

The year 1842 was marked by the Society undertaking, out of its limited means, to erect in the yard used for the accommodation of the Shows, ranges of permanent shedding, which, for many succeeding years, constituted the only covered accommodation for the cattle exhibited.

In the following year the Agricultural Museum was established, and thus the third object proposed in the Report of 1835 was attained; and in November, 1843, the first Exhibition of Farm and Dairy Produce was held, a series of Shows which, taken in connexion with the occasional exhibitions of produce at the Smithfield Club Show in London, has done incalculable good in demonstrating the capabilities of the soil and climate of Ireland for the production of green crops, of a quality which cannot be surpassed by those raised in other portions of the United Kingdom.

The Show of the year 1845 was rendered particularly noteworthy, as on that occasion His Royal Highness the late Prince Consort appeared as a competitor for the Society's Prizes, by exhibiting two surpassingly fine fat oxen (twins), four years and eight months old. In reporting this interesting fact to the Society, the Committee stated that "His Royal Highness was awarded a prize, not only for the best animal in its Section and Class, but also for the best Fat Ox in the yard; and the excellence of the animals shown by the Prince cannot be more clearly demonstrated than by informing the Society, that the two animals exhibited by His Royal Highness sold in the yard for One Hundred and Forty-three Pounds Ten Shillings."

I shall not weary you with the details of the succeeding Shows, but shall merely state the general facts which are embodied in the Report for that year—the extension of the beneficial influence of the Show, and the popularity of the Exhibitions; the former evidenced by the fact that animals were sent to the Show from fifteen counties in Ireland; and the latter by observing that the number of Visiters to the Show, "independently of those having free admissions (who amounted to some hundreds), exceeded, by 2330 persons, that on any former occasion; the total number of persons paying for admission in 1844 being 4764; in 1845, 7094—the receipts consequently amounted to £354 14*s*.—a sum strikingly in contrast to that received on the occasion of the first Show, namely £14.

The Society, while devoting itself to the improvement of the breed of cattle and the system of husbandry throughout the country by means of Exhibitions, did not fail to perceive the importance of the diffusion of sound agricultural knowledge throughout the land; and we consequently find that in the year 1847 a memorial was presented to one of your Excellency's predecessors, recommending the establishment of Agricultural Schools—a recommendation which has since been carried out by the Commissioners of Education in the establishment of three Model Farms, where agricultural instruction, on a very extended scale, is now carried on by accomplished teachers.

The Show of 1851 was the twentieth of the series, and therefore may be taken for the purpose of contrasting its results with those of the first held by the Society:—

	Year 1831.	Year 1851.
Bulls, ...	13	161
Milch Cows, ...	7	50
Heifers, ...	9	92
Fat Stock, ...	21	58
Sheep (lots), ...	6	119
Swine, ...	3	168
Horses, ...	6	25
Fowl, ...	3	281
	65	961
Receipts, . . .	£14	£346

The Shows of 1853 and 1854 are remarkable as having been the first held wholly under cover; of the former the Committee report:—

"Ample and appropriate as the accommodation given by the Society to the Exhibiters has invariably been, on no former occasion were the animals housed to such advantage as on this, through the generous and highly appreciated assistance freely given to the Committee by our distinguished Member, Mr. Dargan, who placed at their disposal, for the purpose of the Cattle Show, two of the magnificent halls erected by him upon the Society's Lawn."

From this time the Spring Shows may be considered as having assumed their maximum dimensions. Thus we find the following as the largest number of entries of each description of Stock, for each of the years, respectively:—

Bulls, ...	225	in	1860.
Cows and Heifers, . .	149	„	1859.
Fat Stock, ...	82	„	1850.
Sheep (lots), ...	119	„	1851.
Swine (lots), ...	168	„	1851.
Horses, ...	54	„	1853.
Poultry (lots), . . .	302	„	1854.
Implements (entries, or individual Exhibiters)	71	„	1858.

As gratifying proofs of the large amount of public confidence the Society enjoys, I may here mention, that within recent years special prizes for the encouragement of agriculture have been entrusted to it. Thus, the Messrs. Purdon, the respected proprietors of the "Irish Farmers' Gazette," presented a cup valued at £150, which, having been won by Colonel Towneley, was replaced by him with one of the same value: another Cup, also valued at £150, was presented by the Railway Companies whose lines terminate in Dublin. Mr. Ganly, the eminent salesmaster, presented a Cup, valued £50; and a similar prize was given by the Messrs. Ferguson, of Grafton-street. Finally, a Cup, of the same value, was last year presented by Mr. Lawes, of Rothamstead, for the encouragement of turnip cultivation in Ireland.

These returns show at one view the success which has attended these Exhibitions; and, to use the words of the Report of the Committee in the year 1855—"Our fair greens and cattle markets, in the most distant parts of the country, exhibit a true reflection of the value of the Society's labours in promoting the production of a highly improved race of cattle, swine, and sheep, in Ireland."

Let it be remembered that the Society's Agricultural Exhibitions are almost wholly self-supporting, a sum of somewhat under £200 being all that is applicable out of the Parliamentary grant towards their support.

In December of the year 1856, the Society first held a Fat Cattle Show, in conjunction with the Show of Farm and Dairy produce; and in the Report of the Committee of Agriculture upon that Exhibition, we find the project first suggested of erecting a permanent hall for the accommodation of the valuable stock exhibited at these Shows.

This suggestion the Society shortly afterwards warmly adopted, and took active measures to realize.

In response to an appeal to the public, a sum of over £2000 was contributed (the late lamented Prince Consort having been a large subscriber); to this the Society added £1500, consisting solely of the subscriptions of the Members. And at length the noble Hall, which affords such admirable accommodation for the valuable stock exhibited, was erected according to plans and estimate of our esteemed Honorary Member, Mr. Frederick V. Clarendon. Subsequently the Galleries were erected, and other improvements effected out of the proceeds of the Art Exhibition of 1861. Thus, the total sum expended upon the building, not any portion of which has been contributed by Parliament, has amounted to above £5000.

Notwithstanding this outlay, a large sum of money was annually expended in erecting temporary shedding on the Lawn, for the exhibition chiefly of Implements. But it being manifestly improper to continue to disfigure the Lawn with such unsightly structures, the Society was compelled to look elsewhere for adequate space on which suitable permanent shedding might be erected.

For the accomplishment of this desirable object, the Society is indebted chiefly to the exertions of Sir Richard Griffith, Bart., whose interest and liberality in this, as in everything calculated to assist the Society in its efforts to benefit the country, are beyond all praise, and entitle him to the lasting gratitude of every true patriot,—aided by the efforts of several other members who made themselves liable for the purchase of the admirable space known as Shelbourne Yard, as well as for the erection in it and other parts of the Society's premises of permanent shedding, which ultimately will effect so material a saving in the expense of the Show as to enable the Society still further to promote and encourage Agriculture.

I may be excused here for reminding our friends, that for these extensive and important improvements a considerable liability has been incurred. But the Society is fully confident that the appeal for subscriptions to liquidate this debt, and to enable it to complete its contemplated improvements, which amount to but £500 or £600, will not be disregarded, but will meet with a liberal and hearty response.

Reverting to one of the objects contemplated by the Committee of 1834—namely, the appointment of a Professor of Agriculture—it is a subject of congratulation that this the Society has been also enabled to accomplish, and to have been so fortunate as to secure the services of a gentleman whose talents and attainments reflect lustre upon the body by whom he has been appointed, and so worthily uphold the reputation of the illustrious name of Davy. In addition to his duties as a Lecturer upon Agriculture, and of giving laboratory instruction in analytical agricultural chemistry, Dr. Davy conducts, according to a tariff of fees regulated by the Society, agricultural analyses and other chemical investigations, in the well-furnished laboratory of this institution.

The Society, however, anxious still further to promote Agriculture, by the systematic employment of its great scientific and practical resources, has lately adopted a scheme for the Education, Examination, and Qualification of Land Stewards and Herds, which it is anticipated will exercise a most beneficial influence on the progress of Agriculture in Ireland. Thus the first of the objects set forth in the Report of 1834 will have been realized.

Having now briefly ventured to describe to your Excellency the efforts which the Society has made to render its Agricultural Establishment useful to the country, let it not be supposed that those other important departments entrusted to its care by the Legislature have been neglected.

Contemporaneously with the holding of its Agricultural Shows, the Society has held Periodical Exhibitions of Manufactures, that of 1834 being the first of its kind held in the United Kingdom,—the last of the series merged into the noble undertaking of Mr. Dargan, in the year 1853. The Society, however, has resolved to revive these periodical Exhibitions, and has decided upon holding, in the summer of 1864, an Exhibition of Irish manufactures, together with machinery from all countries suitable to manufacturing purposes.

During the same period we have continued to provide for the instruction of the public by means of free annual Public Lectures on the several branches of Natural and Experimental Science bearing upon the Industrial Arts, delivered by a staff of experienced and eminent professors, who likewise give courses of lectures in the provincial towns in Ireland. It is earnestly hoped that any changes which are said to be now in contemplation may not render this system of popular instruction less efficient.

We have held Monthly Evening Meetings for the discussion of subjects connected with Agriculture, Science, and Art, at which all persons, whether Members of the Society or not, are invited to bring forward communications, the most valuable of which are subsequently published in the Society's "Journal," and, where requisite, illustrated with engravings, executed at the sole expense of the Society.

We have continued to maintain a Library which, when the State shall have given us means to arrange it in the rooms provided for its extension, for usefulness and ready access by all classes of the scientific and literary public, can hardly be surpassed—a department which is about to be augmented by the munificent gift of the Library of our Honorary Member, Jasper Robert Joly, Esq., LL. D., consisting of about 10,000 volumes, and an equal number of prints, of the most rare and valuable description; and which now requires but the pecuniary aid of Parliament to render it accessible to the Members and the public.

Within the past eight years we have erected, at a cost of upwards of £11,000, *half only of which* has been contributed by Parliament, a splendid building for our extensive National Museum, which, I regret to state, for want of sufficient means, we are unable to complete, and thus afford the public the full benefit of the department.

We have continued to maintain, with marvellous efficiency considering the inadequacy of the sum granted by the State for its support, a Botanic Garden, one of the largest and most picturesque in Europe, in which we have erected, out of our private income, several of the Conservatories and Forcing-Houses, essential in such an establishment.

We have endeavoured to manage, on the self-supporting principle, a School of Art, which the Department of Science and Art considered it advisable to substitute for our previously existing free Drawing Schools—Schools which were rendered illustrious, as the institution which produced such artists as Foley, Lalor, Kirk, Shee, Danby, Grattan, Deane, Murphy, and many others of a scarcely inferior stamp.

We have held, during the past few years, two Exhibitions of the Fine and Ornamental Arts, the latter of which in 1861 will ever be remembered as having been the first in this Society honoured by the presence of his Royal Highness the Prince of Wales, and to which the sad interest attaches as being the last of such exhibitions visited by his illustrious father, our late lamented Vice-Patron.

Within these few past years the Society, with the gratuitous aid of several of its many learned and accomplished members (who, it should be stated, are ready to help the Officers of the Society in every department with their advice and assistance), instituted Annual Examinations in subjects of a General Elementary and Mercantile Education, so as to test the fitness of the Candidates for acting as Clerks to private and public employers; and several of those to whom certificates were awarded obtained employment in Government and other offices. For these certificates the gentler sex has already successfully competed.

This outline will enable your Excellency to judge of the zeal and steady persevering energy, amidst many difficult and discouraging circumstances, with which the Society has endeavoured to fulfil the object for which it exists—namely, "The promotion of Husbandry and other Useful Arts and Sciences in Ireland." I feel sure of its being conceded, that such an Institution must be of great value to any country, but especially to Ireland, in which the members, laying aside their political and religious differences, all heartily combine in the management of the Institution for the benefit of the public—for let it never be forgotten, that the public has the full benefit of every department, the Members reserving for themselves but few and unimportant privileges, as some slight compensation for their gratuitous services, and the large sums which they contribute towards the maintenance of the institution. And I am sure that all who have heard the statement I have now been privileged to submit to your Excellency, will feel convinced that this Society only needs the increased liberality of Parliament, and the continued accession of men of influence and intelligence, to render it the most powerful means that could be devised for promoting the Agricultural, Commercial, and Manufacturing prosperity of Ireland; or, in the language of the report of the Parliamentary Committee of 1836, "the great central association for the diffusion throughout Ireland of a knowledge of Practical Science, and of all improvements in Agriculture, Horticulture, and the Arts."

Mr. Henry Battersby, as a member of the Agricultural Committee, proposed a vote of thanks to the Judges, whom he warmly commended for their impartial decisions. He stated that not a single objection had been lodged against any one of their awards. The greatest care was taken that they should be perfectly ignorant of the owners of the animals, on whose merits they were to decide, until they had given their awards.

Mr. J. W. Naper, D. L., seconded the motion, and in doing so said he was proud to see the "Kerry Celt" standing on an equality with the "Saxon Durham." He said so because he was satisfied exhibiters and proprietors of stock were labouring under considerable difficulty. He considered it was a mistake not to have regard to the wants of those who attended to the stock and brought them to perfection. He was satisfied that so useful and efficient a society as theirs should not omit to give premiums as an encouragement to the labourers. It might be mentioned, incidentally, that he intended sending in a Durham heifer to the show; but she got so fat in two months, owing to the attention paid to her, that her hind legs would not carry her. If labourers saw so much care and anxiety evinced in reference to the rearing of cattle, it was not too much to think they would expect the same interest in respect of their comforts. As an individual connected with those shows, he trusted that they would endeavour to give the Celtic labourer the same rights and privileges which they would grant to the Saxon labourer. A few days since he had been speaking to Sir Richard Griffith on the subject of establishing agricultural villages for the benefit of such classes; but the answer he received was, that the Lords of the Treasury did not like such projects. He was sorry to say, however, that a mistaken notion as to their wants and habits had prevented them coming together to discuss such useful projects. He hoped, however, the Government would more truly understand the wants of the people; and he hoped to see the Kerry lass as well educated, and as well fed, as the Saxon.

Mr. Richard Stratton returned thanks on the part of the Judges. He said that all the classes of short-horns were almost first rate. The elder bulls were beyond anything he saw in Ireland, or, indeed, anywhere else. They were the best bulls in the United Kingdom—so very good, that the Judges had great difficulty in awarding the prizes. The other bulls were also very good; and as to the yearling heifers, he had never seen any superior to them.

Lord Dunlo, Secretary, moved a vote of thanks to his Excellency for his kindness in attending on that occasion, as well as on every other occasion when the industrial resources of the country could possibly be forwarded. It was the good fortune of the Society on such occasions to be aided by the presence of those who held the high position of Viceroy; and he was proud to say that amongst them none did more than his Excellency to promote agricultural progress. It was gratifying to the Society to find his Excellency still entertained a good feeling towards them, because it still required a good

deal of assistance, both private and public. He had much pleasure in moving the marked thanks of the Society to his Excellency.

Mr. F. Macdonogh, Q. C., M. P., seconded the motion. Unexpected as the honour was, he discharged it with pleasure, because he thought no Irish gentleman could avoid expressing his deep sense of the services rendered to the industrial resources of Ireland by Lord Carlisle. Every man who knew Lord Carlisle, and his devotion to the interests of this country, should acknowledge that his attendance there that night was but one of his many gracious acts towards Ireland. He would say of Lord Carlisle that he believed, if he were not born in the purple, that he would, by his talents and by the invariable course of conduct which his noble nature would have prompted him to pursue, have been raised to the highest dignity.

Mr. G. W. Maunsell put the motion, which was passed with acclamation.

His Excellency, on rising, was received with loud applause. He said:—Gentlemen,—I beg to return my very sincere thanks for the vote which has been so kindly moved, seconded, and accepted. I confess it seems to me, gentlemen, that we have come here together under somewhat cheering circumstances. In the first place, the show itself, which is the proper and main business of the place and time, has been eminently successful. This is a topic which I always leave to those who are more specially cognisant of the subject, and who therefore are enabled to render it more accurate justice. That has been very clearly and ably set forth by Mr. Maunsell in his opening address. He was pleased to refer to some rather delicate and not very peaceful functions of an ancestor of mine. Well, gentlemen, it was the business of Belted Will, to whom he refers, to keep peace upon the border, a mere imaginary line. It will be a happier and more cheering duty for his descendant, if he could hope to join his efforts to those of so many others in promoting feelings of the utmost good will and unity between the two spirited nations on either side of the broad Irish Channel. I quite agree with my noble friend, Lord Dunlo, as to the pleasure that most of us feel in finding that the accommodation for this exhibition, furnished upon the premises of the Royal Dublin Society, has received such ample extension and development. Indeed, the accommodation seems to me now to be so nearly complete as to leave little more to be desired. Great credit is due to those gentlemen, who so nobly stepped forward to supply the deficiency; and I wish, in common with some who have gone before me, that we had an opportunity of informing Sir Richard Griffith to his face, how kindly we feel his exertions and public spirit. The accomplished Secretary of the Dublin Society, Dr. Steele, has furnished you with a most striking catalogue of many useful and spirited undertakings which have been effected, or are in course of progress, under the fostering care of this Society; and I join with him and others in wishing that this undertaking may receive in all quarters adequate recognition and encouragement. We cannot, gentlemen, have advanced thus far in the year 1863 without permitting ourselves to congratulate one another upon the very improved character of the season as far as we have hitherto had experience of it. I know, gentlemen, that upon almost all human things there are two parties—one which takes the best possible view, and the other the worst possible view of everything. This has been the case with respect to the condition and general prospects of Ireland. The truth generally may be found to lie between the two extremes; but I think no one upon either side, the *pessimus* or the *optimus* side, will be found to differ as to the extreme ungeniality and untoward character of the three summers through which we have passed; and it is not to be denied that bad effects naturally resulted in all departments of industry—our corn crops, green crops, our herds and our flocks. I am far from attempting to dogmatize or prophesy upon so mysterious and subtle a matter as the weather; but I do believe there is a growing persuasion, partly derived from the actual observation of the seasons, and partly from independent scientific speculations,—among the rest, from observations upon the spots of the sun, and from magnetic currents upon the earth,—which tend to bring about the belief that there is some law which regulates the recurrences of cycles of more or less favourable weather; and, therefore, when we have hitherto experienced a spring which in its warm dryness and its early bloom reminds us of what we all imagine to be the springs of our youth, we cannot help indulging in further visions of bright sum-

mers, golden harvests, and overflowing granaries. One point, however, is clear,—that until we obtain a more accurate knowledge of the laws which regulate the seasons and the conditions of climate, and can act more securely upon them, our caution ought to keep close company with our ignorance; and, gratifying as has been the sight presented to us in our yards to-day, these long ranges of well-limbed, even-backed, silk-skinned cattle, these pens of soft and showy fleeces, these ingenious marvels of machinery, and fresh as I am from admiring and even handling the Royal Butterfly and Soubadar, yet I must not forget that I have heard within a few days a piteous complaint from my own country (Yorkshire), respecting diseased cattle from various parts of Ireland. I will just read the extract from the letter of my correspondent:—"We have been suffering very serious loss for some time past,—I have, no doubt, not been alone, but throughout the whole neighbourhood,—on account of the diseased state of the imported Irish cattle. I have thought the cause arose from the treatment they received on shipboard, and in being driven about to different parts; but, although I have no doubt that that increases the complaint, I have been informed from a reliable source that the foundation was laid in Ireland, in want of care on the part of the breeders in not providing proper shelter for them during the winter seasons. . . . The severe seasons have, no doubt, something to do in laying the foundation of the disease in question." I have always, not without incurring some reproach, laid great stress upon the adaptabilities of the Irish soil and climate to pasture, and the rearing of flocks and herds. I shall not now in any way depart from that creed; but it is obvious that it must be a damaging and self-punishing process to multiply, or in any way extend the growth and rearing of flocks and herds, without taking care that due provision is made both for a sufficient quantity of green crops for their feeding, and for shelter against any unusual rigour and severity of climate. There is nothing like caution and care in preventing these ills, which I will not say the caprices but the irregularities of nature must expose us all to. There is one other still more grave and more inveterate drawback to Irish agriculture, and indeed to Irish prosperity generally, which I do not like to pass entirely without noticing, though I feel it is not the proper time and opportunity to dwell upon it; but I cannot help observing upon an evil which is more mischievous and damaging than the damp of the moistest summers, or the blast of the chilliest winters—I mean the spread of disaffection to the laws, and of recourse to deeds of violence and agrarian crime. Comparing, however, Ireland of to-day with Ireland as it once was, and indeed as I myself remember it, it would be gross injustice not to admit that rapid and manifest progress has been made, not merely in those material improvements, and in those varied processes to which your exhibition has borne such splendid testimony, but also both in the condition and character of the people, and the feelings of the different classes towards each other; and I do trust that both with respect to the turbulence and crimes of men, as well as to the rigour and disturbance of nature, we may say with equal feeling of grateful thanks, though

"Yon sanguine cloud,
Raised by thy breath, can quench the orb of day,
To-morrow he repairs his golden flood,
And warms the nations with redoubled ray."

The proceedings then terminated.

A special meeting of the Royal Dublin Society was held on Thursday, June 25, at two o'clock, at the Society-house, Kildare-street, for the purpose of considering the Report of the Treasury Commissioners relative to "the Royal Dublin Society, the Museum of Irish Industry, and the System of Scientific Instruction in Ireland."

The Earl of Clancarty, Vice-President, in the Chair.

Dr. Steele, Assistant Secretary, read the notice convening the meeting, and the following letter from Mr. Frederick Peel:—

"*Treasury Chambers*, 10*th June*, 1863.

"Gentlemen,—I am desired by the Lords Commissioners of her Majesty's Treasury to transmit for the information of the Royal Dublin Society a copy of the Report of

the Commissioners appointed to inquire into the Society, the Museum of Irish Industry, and the system of scientific instruction in Ireland; and I am to inform you that, in concurrence with their lordships of the Committee of Council on Education, my lords have fully considered the recommendations and views contained in the Report—that they are of opinion that it must be treated as a whole, and request that it may be submitted to the Council and to the Society.

"In the event of the Report receiving the approval of the Society, and the Society being ready to co-operate in the changes as regards the constitution of their executive body which the Commissioners propose, I am to inform you that her Majesty's Government will be prepared to take at once the necessary steps to give effect to these recommendations.

"I am, gentlemen, &c.,

(Signed) "F. Peel.

"*The Secretary to the Royal Dublin Society.*"

The noble Chairman briefly stated the object of the meeting, and called upon the Secretary to state the substance of the Report to be submitted to the meeting.

Mr. G. W. Maunsell, Secretary, said, in opening this matter he would endeavour to do away with erroneous opinions that had got abroad on the subject. The proposal to alter the constitution of the Society did not emanate from them, but from the Government. He had seen it put in print, and had heard it was stated by members, that they were assembling that day to vote their own condemnation. But he thought a little consideration would show the fallacy of that opinion. There was nothing to awaken any feeling of surprise, or any sentiment of distrust or dislike. They would find that they were but carrying out a course that had met with the approval of the Society in former years, namely, that the Society, being dependent for a portion of its funds on its connexion with the Government and the Parliament of the country, was bound, if it approved of it, to adopt any system that the Executive might think fit to impose upon it. He should not carry the Society further back than to allude to the first grand alteration made in the system of the Society. He should merely go back to the report of Mr. Playfair, in the year 1854, on the system adopted in the educational and exhibition departments of this Society, when it was revised and placed on an entirely new footing. It would weary the Society to go at length into the details of what arose on the Report of 1854. The result of the discussion that took place on that Report was, that the Society was placed in connexion with the Department of Science and Art, and to that Department was intrusted the regulation of all the great educational branches of its business. Passing on from the year 1854, he would come to the commencement of last year. The impression that he wished to correct was, that those changes were suggested by the Society; they were changes that had engaged the attention of the heads of the State, and were first brought under the notice of the Society by letters. The first letter written on the subject was that of Mr. Lowe, dated February, 1862. Mr. Lowe was an officer who, from his position, was immediately charged with the responsibility of these duties. In that letter he suggested that the Lords Commissioners of the Treasury should take the subject into their hands, and review the constitution and management of the Society, with the object of considering what measures should be adopted for the control of a Society which derived so large a portion of its funds from the public. Immediately following that letter a deputation from this Society were directed to proceed to London, and they there had an interview with the heads of the Department of Science and Art, with a view of bringing under their attention the requirements of the Society. The deputation were supported by a very large array of the Parliamentary gentlemen then in London. The deputation were accompanied by the Earl of Longford, the members for the city and for the University, and a great number of members representing all shades of opinion from the north and south of Ireland, and were received by Earl Granville, who was in the chair, with great courtesy and respect. It was there pressed on the Government, that, if Dublin was to be represented as a metropolis, it was entitled to institutions eminently metropolitan; and that Society, occupying the position it did in the public confidence, and possessing the numerous and important departments it did, was entitled to receive at the hands of

the Government full and ample support, to enable it to carry on its operations. He did not believe any one present could find fault with the way in which those representations were received by Lord Granville and the other heads of the Department. They expressed themselves ready to enter fully and heartily into all the wants of the Society; but they said that in considering the constitution of the Society, and on reading over its proceedings, they thought there was a manifold defect in the connexion which the Society at present held with the authorities of the State. They found that the Society was so constituted that the Government were obliged to hold communications with it through a body of its members termed the Council; and it was expected that, if that Council was to receive public money for distribution, it should be entrusted with such authority that the Government could hold them responsible for whatever might occur. But the Council as at present constituted was subject to review; and after the public money might have passed from the Treasury into the hands of the Society, as represented by its Council, a different line of action from that in the minds of the Government at the time the money was given might be forced on the Council by the members of the Society, and thus the intentions of Parliament might be defeated, and that without any responsibility attaching to anybody. It was stated distinctly that the Government did not wish to interfere in the local management of the Society; but they would make it a condition of the granting of any aid from Parliament, that whatever body the Society nominated to manage its affairs, be that body large or small, be it annually, biennially, or triennially appointed, it shall be entrusted with full control over the Society's affairs, so that when the heads of the State Department enter into communication with it, they shall feel sure that it will have full powers to deal with the questions that come before it, and that they will not be left in doubt as to the decisions come to by it. Some months after—in May, 1862—Mr. F. Peel concurred in the expediency of instituting an inquiry into the system and construction of the Society, with the view of ascertaining whether any changes might be made, having for their object to provide for the more efficient administration of the affairs of the Society by its Council. The result of that letter was that in June, 1862, a sub-committee was appointed, consisting of Sir Richard Griffith, Mr. D'Olier, Mr. Senior, and Dr. Sidney. Following their Report, by which the Council intimated their readiness to comply with the requirements of the Department of Science and Art, a Commission was appointed by the Government to inquire and report on the subject, consisting of the Lord Justice of Appeal, Sir Charles Trevelyan, and Captain Donnelly. The Treasury sent a copy of their Report to the Society, with the letter of Mr. F. Peel already read. Mr. Maunsell hoped that the members of the Royal Irish Academy and of other societies would not think that they were placed in subordinate positions by the Royal Dublin Society being made the channel for the distribution of Government grants, as such was not the intention, but it was necessary to have a common channel for the distribution of public money. He hoped it was now clearly understood that the idea had never originated with that Society, or any one connected with it, that the Museum of Irish Industry should be closed. No such thought had entered the mind of any of the parties who had given evidence before the Commission, or had been engaged in the preliminary negotiations on behalf of the Society. Mr. Maunsell then read some extracts from the Report, and referred first to a paragraph in the portion in reference to the finances of the Society. It was as follows:—"The Government would, we think, obtain the power of influencing to any necessary extent the application of the aggregate fund without impairing the motive of the Society to increase their incidental receipts, if the following arrangements were adopted:—That the Society should enter upon no new branches of work without the consent of the Government, and that the annual estimate submitted to Parliament should show the whole of the expected income and expenditure of the Society during the ensuing year, whether derived from Parliamentary grants or from other sources. Everything in connexion with the buildings of the Society should continue to be under the charge of the Board of Works, but that Board should communicate with the Department of Science, and that previously to submitting this part of their annual estimate to the Treasury." He did not see anything objectionable in that. The objects of the Society had long been defined and understood, and they were not likely to take any new range; and if they were, if it was beneficial to Ireland, the Government would not object to it. The Report next recommended that £4500 should be expended on the Museum. That would certainly meet with

the unanimous approval of the Society. He observed upon the state of their Library, and the want of proper accommodation for a large number of valuable books belonging to the Society, and said that the Report recommended the appropriation of £1000 for shelving the rooms added to the Library. This part of the Report recommended the opening of the Reading Room every evening of the week (except Sunday) instead of three evenings, as at present, the difficulty at present preventing that being the want of funds to pay attendants. He observed upon several other passages of the Report; and said it came to the general conclusion in reference to the Museums that there should be but one Museum in the city, and not two. He read an extract from the Report, advocating one Museum instead of two on the grounds of economy, of the more efficient manner in which one could be managed, and that many persons, who would visit one museum, would not visit two. The Report likewise proposed to raise the salary of the professorship of agricultural chemistry, and to appoint a professor of botany, as applied to agriculture. He regretted that the Commissioners thought it necessary to abolish certain professorships in connexion with the Museum of Irish Industry, Stephen's-green, which many thought might be judiciously incorporated with that Society. That recommendation, however, might possibly be reviewed. They were then to have technical instruction in two departments of mining, divided into mineralogy and geology; and agriculture, divided into agricultural chemistry and botany. In reference to the constitution of the Society, the proposal was that, while the Council should be invested with full authority to act on behalf of the Society, the influence of the Society at large on the election of the Council should be made more direct and effectual, and that members should retain the privilege of free access to the Library, Museum, lectures, exhibitions, and ordinary scientific meetings of the Society. The Commissioners expressed the belief that, when the constitution of the Council had been improved in the manner proposed, the Royal Dublin Society might be entrusted with the disbursement of the grants of Parliament with as much confidence as the Trustees of the British Museum, or the Board of Manufactures in Scotland. He dwelt at length on the benefits the Society would derive from the recommendations of the Report, if carried out, and concluded by proposing the following resolution—"That the Society hereby accepts the Report of the Treasury Commissioners, so far as it relates to this Society, and is ready to adopt the changes as regards the constitution of its executive body which the Commissioners propose."

The MARQUIS OF KILDARE, V. P., seconded the resolution, which was unanimously adopted.

It was next moved, and seconded—"That it be referred to the Council to revise the By-laws, and report to the Society, at its first meeting in November, what changes and modifications in same might be necessary and desirable, in order to carry out the foregoing resolution."

The meeting then separated.

FEBRUARY, 1863.

DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Sunday,	29·530	45	45	44	47	40	W.	7	Many,	Broken,	·010	Fine, breezy day.
2 Monday,	29·560	46	46	45	47	40	W.	5	Do.	Do.	·120	Stormy and showery.
3 Tuesday,	29·674	39	39	38	43	36	S. W.	8	Do.	Do.	·030	Fine, breezy day.
4 Wednesday,	29·674	49	50	49	51	30	S. W.	0	Do.	Do.	·020	Very stormy day.
5 Thursday,	30·024	51	52	50	53	41	S. W.	0	Do.	Do.	·040	Fine, breezy day.
6 Friday,	30·130	51	52	51	52	49	W.	2	Do.	Do.	..	Do.
7 Saturday,	30·070	46	46	44	48	46	W.	0	Do.	Do.	..	Dull and gloomy.
8 Sunday,	29·950	40	41	39	42	34	S. W.	8	Few,	Do.	..	Fine, sunny day.
9 Monday,	29·950	42	44	42	45	31	S. W.	5	Many,	Do.	..	Fair A. M., overcast P. M.
10 Tuesday,	30·000	50	51	49	51	43	W.	6	Few,	Do.	·020	Showery A. M., fine P. M.
11 Wednesday,	30·000	47	47	45	49	37	W.	8	Many,	Do.	..	Dull and changeable.
12 Thursday,	30·380	46	47	45	50	33	W.	8	None,	....	·020	Fine, clear day.
13 Friday,	30·500	42	45	44	48	25	S. E.	8	Do.	....	..	Do.
14 Saturday,	30·400	42	42	41	47	38	S. E.	8	Do.	....	..	Fine, rather cold.
15 Sunday,	30·400	45	45	43	47	35	S. E.	7	Many,	Broken,	..	Do.
16 Monday,	30·380	47	48	46	49	33	E.	8	Few,	Do.	..	Fine, sunny day.
17 Tuesday,	30·350	48	48	46	49	36	S. W.	6	Many,	Do.	..	Strong breeze, fine day.
18 Wednesday,	30·310	49	51	46	51	45	W.	0	Do.	Do.	·040	Showery day.
19 Thursday,	30·350	45	45	49	47	41	N. E.	8	Few,	Do.	·030	Dull and changeable.
20 Friday,	30·340	40	40	43	42	35	S.	4	Many,	Do.	..	Very fine day.
21 Saturday,	30·300	39	40	39	44	33	S. E.	6	Do.	Do.	..	Fine A. M., changeable P. M.
22 Sunday,	30·280	40	40	38	42	32	W.	7	Do.	Do.	·040	Fine, rather cold.
23 Monday,	30·270	45	45	43	49	40	W.	0	Do.	Do.	..	Dull and mild.
24 Tuesday,	30·200	47	47	46	49	41	S.	0	Do.	Do.	..	Do.
25 Wednesday,	30·180	49	49	47	51	44	S. W.	3	Do.	Do.	..	Fine, breezy day.
26 Thursday,	30·000	50	51	49	51	43	W.	4	Do.	Do.	..	Do.
27 Friday,	29·980	51	52	50	53	45	S. W.	0	Do.	Do.	..	Strong breeze, like rain.
28 Saturday,	29·350	47	49	47	50	44	S.	2	Do.	Do.	·030	Rain A. M., fair P. M.
								129	Total Amount of Rain,		·400	inches.

FEBRUARY, 1863.

DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Sunday, ...	29·530	45	45	44	47	40	W.	7	Many, . .	Broken, . .	·010	Fine, breezy day.
2 Monday, ...	29·560	46	46	45	47	40	W.	5	Do. . .	Do. . . .	·120	Stormy and showery.
3 Tuesday, ...	29·674	39	39	38	43	36	S. W.	8	Do. . .	Do. . . .	·030	Fine, breezy day.
4 Wednesday, . . .	29·674	49	50	49	51	30	S. W.	0	Do. . .	Do. . . .	·020	Very stormy day.
5 Thursday, ...	30·024	51	52	50	53	41	S. W.	0	Do. . .	Do. . . .	·040	Fine, breezy day.
6 Friday, ...	30·130	51	52	51	52	49	W.	2	Do. . .	Do. . . .	. .	Do.
7 Saturday, ...	30·070	46	46	44	48	46	W.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
8 Sunday, ...	29·950	40	41	39	42	34	S. W.	8	Few, . .	Do. . .	. .	Fine, sunny day.
9 Monday, ...	29·950	42	44	42	45	31	S. W.	5	Many, . .	Do. . . .	. .	Fair A. M., overcast P. M.
10 Tuesday, ...	30·000	50	51	49	51	43	W.	6	Few, . .	Do. . . .	·020	Showery A. M., fine P. M.
11 Wednesday, . . .	30·000	47	47	45	49	37	W.	8	Many, . .	Do. . . .	. .	Dull and changeable.
12 Thursday, ...	30·380	46	47	45	50	38	W.	8	None, . .	. . . . . .	·020	Fine, clear day.
13 Friday, ...	30·500	42	45	44	48	25	S. E.	8	Do. . .	. . . . . .	. .	Do.
14 Saturday, ...	30·400	42	42	41	47	38	S. E.	8	Do. . .	. . . . . .	. .	Fine, rather cold.
15 Sunday, ...	30·400	45	45	43	47	35	S. E.	7	Many, . .	Broken, . .	. .	Do.
16 Monday, ...	30·380	47	48	46	49	33	E.	8	Few, . .	Do. . . .	. .	Fine, sunny day.
17 Tuesday, ...	30·350	48	48	46	49	36	S. W.	6	Many, . .	Do. . . .	. .	Strong breeze, fine day.
18 Wednesday, . . .	30·310	49	51	46	51	45	W.	0	Do. . .	Do. . . .	·040	Showery day.
19 Thursday, ...	30·350	45	45	49	47	41	N. E.	8	Few, . .	Do. . . .	·030	Dull and changeable.
20 Friday, ...	30·340	40	40	43	42	35	S.	4	Many, . .	Do. . . .	. .	Very fine day.
21 Saturday, ...	30·300	39	40	39	44	33	S. E.	6	Do. . .	Do. . . .	. .	Fine A. M., changeable P. M.
22 Sunday, ...	30·280	40	40	38	42	32	W.	7	Do. . .	Do. . . .	·040	Fine, rather cold.
23 Monday, ...	30·270	45	45	43	49	40	W.	0	Do. . .	Do. . . .	. .	Dull and mild.
24 Tuesday, ...	30·200	47	47	46	49	41	S.	0	Do. . .	Do. . . .	. .	Do.
25 Wednesday, . . .	30·180	49	49	47	51	44	S. W.	3	Do. . .	Do. . . .	. .	Fine, breezy day.
26 Thursday, ...	30·000	50	51	49	51	43	W.	4	Do. . .	Do. . . .	. .	Do.
27 Friday, ...	29·980	51	52	50	53	45	S. W.	0	Do. . .	Do. . . .	. .	Strong breeze, like rain.
28 Saturday, ...	29·850	47	49	47	50	44	S.	2	Do. . .	Do. . . .	·030	Rain A. M., fair P. M.
								129	Total Amount of Rain,		·400	inches.

MARCH, 1863.

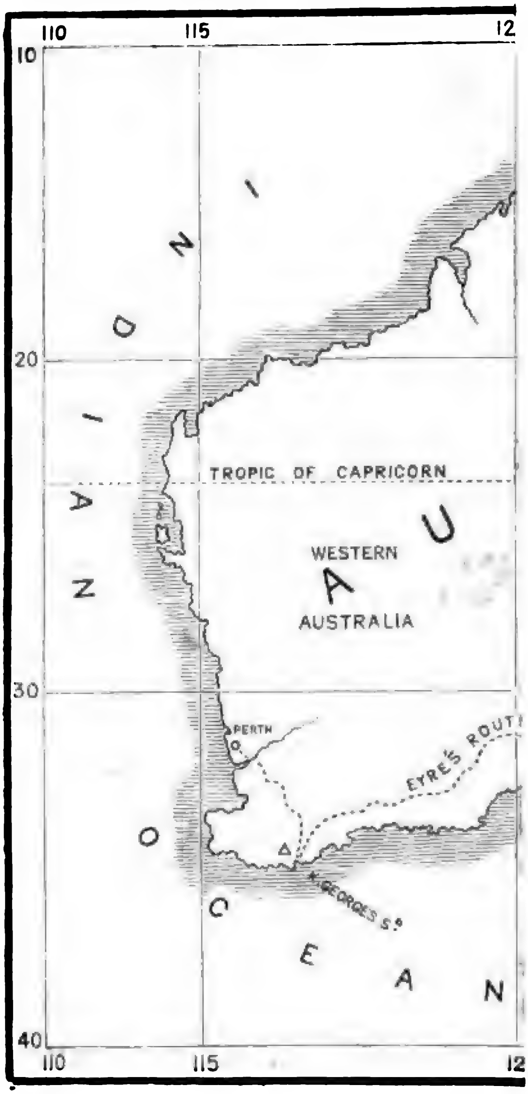
DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Sunday, ...	29·550	47	47	45	50	45	W.	6	Many, . .	Broken, . .	·050	Breezy and showery.
2 Monday, . . .	29·470	54	55	58	55	44	S. W.	0	Do. . .	Do. . . .	·010	Strong breeze, like rain.
3 Tuesday, ...	29·470	53	53	50	53	51	S. E.	3	Do. . .	Do. . . .	·020	Dull, breezy day.
4 Wednesday, . .	29·470	50	51	49	52	44	S. W.	7	Do. . .	Do. . . .	·010	Fine, mild day.
5 Thursday, . . .	29·400	50	50	48	51	45	S.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
6 Friday, ...	29·220	45	46	44	47	39	S. W.	0	Do. . .	Do. . . .	·470	Wet, dull day.
7 Saturday, . . .	29·220	45	45	43	45	35	W.	4	Do. . .	Do. . . .	·020	Showery day.
8 Sunday, ...	29·620	39	39	38	41	33	W.	7	Do. . .	Do. . . .	·040	Do.
9 Monday, ...	29·350	40	42	40	43	26	S. E.	6	Do. . .	Do. . . .	. .	Fine, rather cold.
10 Tuesday, ...	29·270	41	41	38	45	28	E.	8	Few, . .	Do. . . .	. .	Fine, clear day.
11 Wednesday, . .	28·970	43	44	43	45	28	E.	8	Do. . .	Do. . . .	. .	Do.
12 Thursday, . . .	28·870	45	46	44	47	38	W.	4	Many, . .	Do. . . .	·510	Wet A.M., fair P.M..
13 Friday, ...	29·450	47	47	45	48	37	N. E.	8	Few, . .	Do. . . .	. .	Gloomy A.M., clear P.M.
14 Saturday, . . .	29·150	47	48	45	48	31	N. W.	5	Many, . .	Do. . . .	·020	Showery day.
15 Sunday, ...	29·500	47	47	45	48	45	N. W.	6	Do. . .	Do. . . .	·060	Dull and changeable.
16 Monday, ...	30·170	48	48	46	49	39	N. E.	9	Do. . .	Do. . . .	. .	Fine, breezy day.
17 Tuesday, ...	30·200	45	45	44	47	27	E.	9	Few, . .	Do. . . .	. .	Fine, clear day.
18 Wednesday, . .	30·020	45	47	45	47	36	N. E.	7	Many, . .	Do. . . .	·330	Rain A.M., fair P.M.
19 Thursday, . . .	29·980	49	40	47	50	32	S. E.	6	Do. . .	Do. . . .	. .	Dull and gloomy.
20 Friday, ...	29·830	50	50	48	51	38	N. W.	8	Do. . .	Do. . . .	·010	Very stormy and showery.
21 Saturday, . . .	30·050	50	51	49	51	39	S. W.	3	Do. . .	Do. . . .	. .	Fine, mild day.
22 Sunday, ...	30·050	54	54	53	55	40	S. W.	10	Do. . .	Do. . . .	. .	Fine, sunshiny day.
23 Monday, ...	30·318	57	57	56	58	42	S. W.	8	Do. . .	Do. . . .	. .	Fine, breezy day.
24 Tuesday, . . .	30·412	53	53	52	54	48	W.	0	Do. . .	Do. . . .	. .	Do.
25 Wednesday, . .	30·360	50	50	48	51	47	S. W.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
26 Thursday, . . .	30·360	54	54	53	57	47	N. W.	9	Do. . .	Do. . . .	. .	Fine, breezy day.
27 Friday, ...	29·250	55	55	52	57	39	N. W.	7	Do. . .	Do. . . .	·010	Breezy and showery,
28 Saturday, . . .	29·900	52	52	50	55	46	N. W.	2	Do. . .	Do. . . .	. .	Stormy, like rain.
29 Sunday, ...	29·800	53	53	51	53	44	S. E.	3	Do. . .	Do. . . .	. .	Gloomy and changeable.
30 Monday, ...	30·000	52	53	52	53	43	S. E.	4	Do. . .	Do. . . .	. .	Do.
31 Tuesday, . . .	30·000	54	54	52	54	43	S. W.	3	Do. . .	Do. . . .	. .	Fine, mild day.
								160	Total Amount of Rain,		1·560	inches.

APRIL, 1863.

DATE. Day. At 4 o'Clock, P.M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Wednesday, . . .	30·050	56	57	55	57	45	S. W.	7	Many, . .	Broken, . .	. .	Fine, mild day.
2 Thursday, . . .	30·100	57	57	55	58	46	S. W.	6	Few, . .	Do. . . .	. .	Very fine day.
3 Friday, ...	30·100	55	56	54	56	40	S. W.	10	Many, . .	Do. . . .	·100	Fine, sunshiny day.
4 Saturday, ...	29·870	50	51	49	51	45	W.	10	Do. . .	Do. . . .	·050	Fine, breezy day.
5 Sunday, ...	29·450	49	49	46	50	45	S. W.	2	Do. . .	Do. . . .	·310	Very wet day.
6 Monday, ...	29·300	49	50	47	51	39	S.	10	Do. . .	Do. . . .	·060	Fine day, light showers.
7 Tuesday, ...	29·824	45	46	43	50	34	W.	8	None, . .	. . . .	·080	Cold breeze, hail showers.
8 Wednesday, . . .	29·380	51	52	50	54	37	S. W.	9	Many, . .	Broken, . .	·030	Rather cold, fine day.
9 Thursday, . . .	29·700	49	50	49	52	40	S. W.	8	Do. . .	Do. . . .	. .	Do.
10 Friday, ...	29·800	50	52	50	52	38	W.	7	Do. . .	Do. . . .	. .	Fine, mild day.
11 Saturday, ...	29·940	50	50	49	54	39	S. W.	10	Do. . .	Do. . . .	. .	Fine, sunshiny day.
12 Sunday, ...	29·950	52	52	50	54	30	W.	10	Do. . .	Do. . . .	. .	Do.
13 Monday, ...	29·900	53	54	53	54	32	W.	9	Do. . .	Do. . . .	. .	Fine, breezy day.
14 Tuesday, ...	29·770	53	55	53	56	48	S. W.	7	Do. . .	Do. . . .	·020	Showers A.M., fair P.M.
15 Wednesday, . . .	29·850	50	52	50	53	44	S. W.	6	Do. . .	Do. . . .	·020	Mild and changeable.
16 Thursday, . . .	29·970	52	54	52	55	44	W.	9	Do. . .	Do. . . .	·140	Fine, mild day.
17 Friday, ...	30·100	57	58	57	59	42	N. W.	9	Do. . .	Do. . . .	. .	Gloomy and changeable.
18 Saturday, ...	30·000	55	55	53	56	40	S. W.	7	Do. . .	Do. . . .	. .	Do.
19 Sunday, ...	29·900	52	52	50	54	30	W.	0	Do. . .	Do. . . .	·120	Very wet day.
20 Monday, ...	29·680	49	50	48	51	35	N. W.	5	Do. . .	Do. . . .	·040	Very changeable.
21 Tuesday, ...	29·490	51	53	50	54	49	W.	8	Do. . .	Do. . . .	·040	Showery, and very stormy.
22 Wednesday, . . .	29·750	51	52	50	54	41	W.	8	Do. . .	Do. . . .	·200	Heavy showers during day.
23 Thursday, . . .	30·280	54	54	52	54	37	N. W.	10	Do. . .	Do. . . .	·030	Fine, rather cold.
24 Friday, ...	30·300	56	56	54	58	32	N. W.	10	Do. . .	Do. . . .	. .	Fine, mild day.
25 Saturday, ...	30·200	55	56	54	59	36	W.	10	Do. . .	Do. . . .	. .	Do.
26 Sunday, ...	30·100	54	55	53	57	32	N. W.	10	Few, . .	Do. . . .	. .	Fine, sunshiny day.
27 Monday, ...	30·000	54	54	51	55	31	N. W.	10	Many, . .	Do. . . .	. .	Strong breeze, changeable.
28 Tuesday, ...	29·950	51	52	50	55	35	N. W.	8	Do. . .	Do. . . .	·060	Gloomy and showery.
29 Wednesday, . .	30·120	51	51	50	57	37	N. W.	10	Do. . .	Do. . . .	. .	Fine, sunshiny day.
30 Thursday, . . .	30·250	55	55	53	56	33	N. E.	10	Do. . .	Do. . . .	. .	Do.
								238	Total Amount of Rain,		1.300	inches.

MAY, 1863.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day. At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Friday, ...	30·200	57	57	56	59	39	E.	10	Few, . .	Broken, . .	. .	Fine, clear day.
2 Saturday, . . .	30·028	57	59	57	60	40	E.	8	Many, . .	Do. . . .	. .	Fine, mild day.
3 Sunday, ...	29·900	54	57	55	59	44	W.	6	Do. . .	Do. . . .	. .	Dull and changeable.
4 Monday, ...	29·730	57	58	55	59	47	W.	9	Do. . .	Do. . . .	. .	Stormy, like rain.
5 Tuesday, ...	29·930	54	55	54	58	46	N. W.	10	Few, . .	Do. . . .	. .	Very fine day.
6 Wednesday, . .	29·830	57	59	57	60	37	S. W.	10	Many, . .	Do. . . .	·030	Breezy and showery.
7 Thursday, . . .	30·270	54	56	54	60	37	S. E.	10	None, . .	. . . .	. .	Fine, sunshiny day.
8 Friday, ...	30·100	60	63	61	67	33	N. W.	10	Do. . .	. . . .	. .	Do.
9 Saturday, . . .	29·970	60	61	59	64	38	N. W.	10	Many, . .	Broken, . .	. .	Changeable, like rain.
10 Sunday, ...	29·900	65	67	65	68	33	N. W.	10	Do. . .	Do. . . .	. .	Fine, sunshiny day.
11 Monday, ...	29·500	53	55	52	57	41	S. W.	4	Do. . .	Do. . . .	·380	Very stormy, and rain.
12 Tuesday, ...	29·800	65	67	65	68	37	S. W.	10	Do. . .	Do. . . .	. .	Fine, mild day.
13 Wednesday, . .	29·400	63	64	62	66	44	S. W.	2	Do. . .	Do. . . .	·200	Showery day.
14 Thursday, . . .	29·500	50	53	51	53	45	S.	0	Do. . .	Do. . . .	·180	Very wet day.
15 Friday, ...	29·650	55	57	55	58	42	S. W.	9	Do. . .	Do. . . .	·160	Fair A.M., showery P.M.
16 Saturday, . . .	29·650	56	57	55	59	43	S. W.	10	Do. . .	Do. . . .	·020	Showery day.
17 Sunday, ...	29·750	54	55	53	55	45	N. E.	10	Do. . .	Do. . . .	·090	Do.
18 Monday, ...	29·970	56	57	55	58	41	N. E.	10	Do. . .	Do. . . .	·120	Breezy and changeable.
19 Tuesday, ...	30·060	50	51	50	53	45	N. E.	8	Do. . .	Do. . . .	. .	Breezy, rather cold
20 Wednesday, . .	30·160	50	52	50	53	44	N. E.	9	Do. . .	Do. . . .	. .	Do.
21 Thursday, . . .	30·160	52	53	52	54	43	N. E.	10	Do. . .	Do. . . .	. .	Breezy and changeable.
22 Friday, ...	30·050	53	53	55	55	45	N. E.	10	Few, . .	Do. . . .	. .	Fine, sunshiny day.
23 Saturday, . . .	29·924	50	52	50	52	42	N. E.	10	Many, . .	Do. . . .	. .	Do.
24 Sunday, ...	30·000	55	56	55	56	31	N. W.	10	Do. . .	Do. . . .	. .	Do.
25 Monday, ...	30·090	55	57	56	59	34	E.	10	None, . .	. . . .	. .	Do.
26 Tuesday, . . .	30·180	57	59	57	61	41	N. W.	10	Do. . .	. . . .	. .	Do.
27 Wednesday, . .	30·250	60	66	65	66	46	W.	10	Many, . .	Broken, . .	. .	Do.
28 Thursday, . . .	30·290	65	67	65	69	51	W.	10	Few, . .	Do. . . .	. .	Sultry, warm day.
29 Friday, ...	30·160	65	67	65	67	50	S. W.	10	Many, . .	Do. . . .	. .	Breezy, and changeable.
30 Saturday, . . .	30·150	62	67	65	67	56	W.	0	Do. . .	Do. . . .	. .	Do.
31 Sunday, ...	30·154	66	68	66	69	57	N. W.	10	Few, . .	Do. . . .	. .	Sultry, warm day.
								266	Total Amount of Rain,		1·180	inches.



Starting point of routes, ...
Terminus, ... Δ
Geographical centre, ... q

Eyre, from Port Lincoln to King George's Sound, throu
deserts, in 1840-41. (Not 1836-7, as stated in former Map

Leichhardt, from Moreton Bay to Port Essington, tr
tricts of well-watered uplands.

Sturt penetrated the interior, from the south, through
country, to lat. 24° 30', long. 138°.

WHITBY.

No. XXXI.] OCTOBER, 1863—JULY, 1864. [Price 2s.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

CONTENTS:

PAGE.

1. Dr. Moore's Botanical and Horticultural Tour through Parts of Scandinavia, Germany, and Belgium, ... 189
2. Dr. Mapother on Labourers' Diet, ... 205
3. Mr. Reynolds on Spectrum Analysis, ... 218
4. Mr. O'Hara on the Supply of Fuel in Ireland, ... 225
5. Mr. Reynolds on Albumin and certain of its Metallic Combinations, ... 249
6. Mr. Lawes on the Chemistry of the Feeding of Animals for the Production of Meat and Manure, ... 256
7. Return of Donations to the Royal Dublin Society, ... 278
8. Intelligence, ... 284

Appendix—Meteorological Journal for the Months of June, July, August, September, October, November, and December, 1863; January, February, March, April, May, and June, 1864, ... vii

DUBLIN:
HODGES, SMITH, AND CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.
1864.

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

The Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Registrar:—

Life Membership, ...	£21 0 0
Annual Membership (with £3 3s. Entrance Fee),	2 2 0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15s.

I.—Meetings of the Society.

1. *Stated and Ordinary Meetings.*

The Society meets at 2 o'Clock P. M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday in November.

2. *Evening Scientific Meetings.*

Meetings of the Society and of the Associated Societies, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session. The business is conducted in the following sections:—

I. Agriculture and Rural Economy, and Horticulture.

II. Fine Arts.

III. Natural Sciences, including Zoology, Botany, Physiology, Mineralogy, Geology, Physical and Descriptive Geography.

IV. Experimental Sciences, including Physics, Chemistry, Physiology, Meteorology, and the Mechanical Arts.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society, and in the Quarterly Journal of Science.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5s. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6d. each; or to twelve for 5s., available for any of the ordinary Meetings throughout the Session.

The Council and Committees.

The Council, which comes into office in January, meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

Eight Standing Committees are annually elected, as follows:—1. Agriculture; 2. Botany; 3. Chemistry; 4. Fine Arts; 5. Library; 6. Manufactures; 7. Natural History; 8. Natural Philosophy. Besides these are the Evening Meetings Committee and Sectional and occasional Committees.

[*For continuation, see page* 3 *of Cover.*

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

OCTOBER, 1863, TO JULY, 1864.

XVIII.—*Notes on a Botanical and Horticultural Tour through Parts of Scandinavia, Germany, and Belgium, in the Year* 1863. By D. MOORE, Ph. D., F. L. S., &c., Curator of the Botanic Garden, Glasnevin.

[Read December 21, 1863.]

HAVING on previous journeys visited most of the principal botanical gardens and other plant establishments on the Continent, I felt desirous this year to break new ground, and resolved on going to Scandinavia. The Committee of Botany having approved of the scheme, and granted the necessary leave of absence, &c., I arranged to accompany two friends who were going from Ireland, whose objects for making the journey were similar to mine. I left Glasnevin on the 17th of June, being two days before the steamer sailed from Hull to Christiania, in order that I might visit some plant collections in Yorkshire on my way. The first I called at was the Messrs. Stansfield's nurseries, at Todmorden, where a fine collection of both hardy and tender Ferns is cultivated. It is particularly rich in the varieties of British species, some of which differ so widely from their normal types as to be scarcely recognisable as mere varieties of them, and when grown to large plants are very handsome. Among the more recent and remarkable of these, I may mention *Athyrium filix-fœm.*, in a variety, *apuaforme;* ditto, variety *grandiceps;* ditto, variety *plumosum;* ditto, variety *Fieldiæ*, &c., &c.; *Scolopendrum vulgare*, variety *Cristatum;* ditto, variety *Polydactylon;* ditto, *Marginatum, Papillosum*, and *Lastrea filix-mas*, variety *Jervisii;* ditto, *Cristata angustata;* ditto, variety *Furcans*, &c., &c.; with many more curious kinds, some of which I got in the way of exchange.

Being anxious to see Mr. Backhouse's fine collection at York, I went there for that purpose. At this extensive establishment the rare and

more difficult kinds of Ferns to cultivate are grown in houses constructed specially for the purpose. They are underground rock-work houses, in which a nearly uniform temperature and great humidity in the atmosphere can be constantly kept,—thus assimilating the climate to that of a dense virgin forest in some of the West India Islands. The success which has attended the efforts already made there to accomplish the objects mentioned is very great, and can only be fully appreciated by those who have had practical experience of the many difficulties which have to be overcome before the different species of foreign Trichomanes and Hymenophyllum can be grown in Britain. At York many of the kinds appear in luxuriant health, under the treatment they receive, and their rhizomes begin to spread about freely.

On the rock-work out of doors a large piece of *Gleichenia dicarpa*, *β. alpina*, was pointed out to me, where it had stood a winter without protection. If this plant on further trial be found quite hardy, and to grow freely, it will certainly prove a fine addition to our present stock of hardy Ferns.

On leaving York my next stage was Hull, where I spent an afternoon in the Botanic Garden, which is under the superintendence of Mr. Niven. There the collection of Alpine plants, cultivated in pots, is a very extensive one, and kept in a fine healthy condition. The herbaceous collection, cultivated in the different classes through the ground, is also a good one, and altogether this garden is in a thriving condition at present.

It was on the morning of the 20th the "Scandinavian" sailed from Hull for Christiania, and, after a fine passage across the North Sea, we reached Christiansand early on the morning of the 22nd. On learning that the vessel would remain here a couple of hours or more, we went on shore, and had a ramble over the rocks, which rise in a picturesque manner around the beautiful harbour, and also over the town. Among the first plants picked up were the following—*Linnea borealis*, *Ajuga pyramidalis*, *Trientalis Europea*, *Cornus Suecica*, *Silene rupestris*, and *Asplenium septentrionale*. *Syringa vulgaris*, which had been a month out of flower before we left England, was still in full flower here. Sycamore, lime, and horse chestnut trees appeared to thrive sufficiently well in the little gardens near the town, but the great mass of wood which covered nearly the whole face of the country consisted of spruce and Scotch firs. After a short stay on terra firma we were again summoned on board, when the steamer started for Christiania.

On leaving the harbour we passed numerous boats sailing up to the town with mackerel, which were all managed by women, who appeared expert sailors. The fishermen who have their houses on the coast near the harbour go out to fish at night, and the women are ready to take charge of the boats in the morning to bring them up to Christiansand to sell the fish, thus allowing the men to get rest and sleep. During the whole day we skirted along the coast within a short distance of it, which enabled the passengers to get a good view of the beautiful scenery

it presents. The low rugged hills were everywhere covered with dense black pine forests, which came close down to the sea, whilst farther in the distance mountains of much greater elevation were visible, with black patches of forest only reaching partly up their sides. At 9 o'clock in the evening we past the light house at the entrance of the Christiania fiord, when the twilight kind of darkness which occurred a short time before and after midnight prevented our seeing the scenery on the shores of this fiord. It was, however, sufficiently light again between 1 and 2 o'clock next morning, when we went on deck and enjoyed the fine scenery until the ship reached Christiania at 4 o'clock. After breakfast we waited on the British consul, Mr. Crowe, who received us with his well-known urbanity of manner, and, on learning the route we intended following, he kindly offered letters of introduction to my two friends who were going to Hammerfest, with the intention to cross over Lapland to the Gulf of Bothnia. Various circumstances prevented me from making so long a journey, hence I only proposed to accompany them to Trondhjem. Whilst my friends were making preparations I went to the Botanic Garden, which is about an English mile from the town. Soon after arriving there I met the active practical superintendent, M. Moe, who conducted me over the establishment, and enabled me to make a good list of *desiderata*. Professor Schubeler was not at home when I called, consequently I did not see him.

The Botanic Garden is beautifully situated on an eminence which overlooks the harbour, and ships are constantly entering and leaving during the summer months. It joins the park in which the royal palace stands, and can be easily reached by walking through the park. It is laid out more to suit the piece of ground on which it rests than it is to any regular plan. The range of conservatories is not extensive; and only affords an inferior kind of accommodation for plants in the different divisions. Those cultivated consist principally of South African and Australian kinds, among which are a good many Mesembryanthemums, Aloes, Sempervivums, &c. The herbaceous plants out of doors are arranged in classes and orders, according to the system of De Candolle, and contain among them a large assortment of well named kinds. Cyperaceæ and Gramineæ were favourite families with the late Professor Blytt, and M. Moe is well up in them also. Besides, the Flora of Norway is peculiarly rich in Carici; and the climate is favourable for their cultivation, hence the best collection I have seen in any European garden is to be found at Christiania. I was able to select about fifty species for the present collection at Glasnevin, which has hitherto been considered a pretty full one.

The grasses contained among them a number of rare alpine kinds, which I have long been anxious to get, but never could lay hold of before.

The coniferous plants, so beautiful in English gardens, are cultivated at Christiania in pots, and moved into the conservatory during winter; common laurels and laurustinus are treated similarly. The *Arbor vitæ, Thuja orientalis,* with one or two of the hardier

kinds, have stood out three years, and seem to thrive very well in sheltered spots, which leads me to think there are a good many more now under cultivation in Britain sufficiently hardy to grow in the south of Norway. A large horse chestnut stands at the entrance gate, which must be a very aged tree. Rows of deciduous trees are planted along the sides of the walks and drives through the park, in which the royal palace stands, consisting principally of limes, ash, oak, and sycamore. They produce a good effect among the groups of natural spruce and Scotch firs, which are still standing in some places, besides affording a desirable shade in summer, when it is sometimes very hot. During two days when I was in Christiania, Fahrenheit's thermometer reached 75 and 80 degrees in the shade, between 12 and 2 o'clock. The shrubs generally cultivated are species of Spiræa, Philadelphus, Viburnum, Robinia, Rubus, and Rosa, which flower much better and more profusely than they do in England. *Spiræa Lindleyana* becomes a magnificent plant there! The old-fashioned yellow Austrian rose made a fine appearance in shrubberies. Light, and also heat, but especially the former, being greater there during the summer months than with us, favour the production of blossoms, which appeared to me to be brighter in colours, and also stronger in perfumes. But the seasons are too short for most of our fruits ripening. Cherries, with some of the hardier kinds of apples and pears, are cultivated near Christiania, but, so far as I could learn, do not arrive at great perfection. The strawberries offered for sale in the market were the fruit of the common wood kind, *Fragaria vesca*. Potatoes, peas, and some other sorts of vegetables, were very good. Most of our half-hardy bedding-out plants, grow well, and flower abundantly. Pelargoniums, petunias, calceolarias, dahlias, balsams, carnations, &c., &c., made beautiful beds in the Park, and also in front of some of the houses in the suburbs of Christiania. The Museum of Natural History, which I visited on my return from the North, is rich in specimens, and appeared to be well managed. Professor Esmach received me with much courtesy, and took great pains to show me everything he could. The collection of invertebrate animals appeared to be particularly good and well exhibited. In his room lay open a volume of the "Transactions of the Royal Irish Academy," which contained the late Professor Kinahan's paper on Crustacea, which Dr. Esmach was studying when I called. On our passage from Hull we were fortunate to meet Mr. Goodman, of London, who has a large property at Sarpsborg, at the great falls of the Glommen River, and who kindly invited us to accompany him to his residence, and see his farming operations, saw mills, manufactory of agricultural implements, &c., holding out the farther inducement, that the volume of water rolling over the falls was greater than it had been for a number of years. After some consideration we accepted his invitation, and started by steamer from Christiania to Moss, a village about forty miles up the fiord, where his carriage was waiting to take us to Sarpsborg. This proved a delightful journey, the morning being bright and warm as that of any midsummer day could possibly be, which, by the way, is kept a general holiday

throughout Norway. The people had put on their best suits, and the school children were collected in groups near the little villages and hamlets on the shores of the fiord, where they were playing and feasting under flags flying, as we passed along. The steamer sailed quite close to the land, so much so, that I was enabled to recognise such plants as *Spiræa filipendula*, *Elymus arenarius*, &c., on shore. The rocks, which rise almost perpendicularly to a considerable elevation in many places, being almost bare of earth, and much rounded by the action of ice, are thickly covered with spruce and Scotch firs, birch, poplar, and juniper. The poplars, *Populus tremula*, were in many instances without heads, which Mr. Goodman told us was caused by the people cutting the heads and slender branches off, for the purpose of assisting to feed the sheep in winter!

The little farms and arable spots which occurred in the valleys between the low hills looked pretty and green, as contrasted with the black pine woods. From Moss to Sarpsborg, we passed through some good arable land, where the farms seemed rather extensive, and in many instances well cultivated. Rye, wheat, oats, and barley, were the principal white crops; but potatoes and turnips were also cultivated in fair proportion, especially the potato. The farm houses and cottages of the peasants had a clean look outside, with an air of comfort apparent, which we frequently fail to see among those located in countries more highly favoured by nature. Being St. John's Day, every house had boughs of juniper and birch placed over the doors, and on the door steps, so that a person entering would necessarily require to touch them with both head and feet. I made some inquiry respecting this general practice by the Norwegian people on St. John's Day, but could not learn anything farther than it was an old custom, and kept up as such. It is, however, probable, that a more satisfactory reply to the query can be given than we received; for, although all northern nations are known to adhere with much tenacity to old customs, they are generally traceable to religious ceremonies once common among the people. For example, on the previous evening, St. John's Day eve, as it is called, bonfires were blazing on all the heights round Christiania, which is a common custom through Scandinavia, as it is with ourselves, and this antiquaries seek to connect with the ancient fire worship by the early inhabitants of those countries.

The road passes through extensive forests of large trees, consisting of spruce and Scotch firs, among the roots of which, and in many places the whole surface of the ground was covered with dense masses of the charming *Linnea borealis*, then in full bloom, and sending forth a delicious fragrance, which scented the atmosphere at a considerable distance. *Cornus Suecica*, *Pyrola secunda*, *Pyrola minor*, *Rubus chamæmorus*, *Mainthemum bifolium*, *Polypodium phegopteris*, *Polypodium dryopteris*, *Lastrea oreopteris*, and *Lastrea spinulosa*, were all common roadside plants. After dinner, Mr. Goodman took us to see the celebrated falls of the Glommen, or Sarpfos, as it is called, which was then higher than the water had been known to rise for some years before. A tre-

mendous volume was pouring over the two broken ledges of rocks which constitute this fall with terrific force, causing the large logs of timber which in hundreds were rolling about in the eddies below the fall, to appear like so many straws. The machinery at the different works had to be stopped at the time, owing to the force of the water; but even when at the lowest, the fall is 116 Norsk feet in width, and 26 in depth, the Norsk foot being = 1·029 English. On rocks near the river, *Woodsia ilvensis* and *Asplenium septentrionale* abounded, along with *Lychnis viscaria*, *Silene nutans*, and several good Hieracea. The rocks were black in some places with Gyrophora, and produced some good mosses, which time did not permit us to look after, it being then after ten o'clock at night.

We got out early next morning and had a better look over Mr. Goodman's farming operations. One of the farms is 400 acres in extent, and is cultivated on something like the five-years shift system, though differing somewhat from it. The first year the ground lies in fallow until autumn, when a crop of rye is sown, with sometimes Timothy grass seeds and red clover, along with the rye, but more frequently the grass and clover are not sown until the spring of the second year. The third year is consequently meadow, and the fourth year also is allowed to remain meadow, without more grass seeds or clover being sown. The fifth year is oats or bere (bug in Norsk); sometimes turnips and potatoes follow the white crops of the fifth year, before the ground is allowed to rest in fallow, preparatory to a crop of rye. I observed both here and elsewhere some excellent meadow of the first year, but that of the second year seemed to be almost a lost crop. Italian and perennial rye grasses have been tried, but they have been generally found to grow too luxuriantly, and not to be so much relished by the cattle as the Timothy, hence it is almost the only cultivated grass seen in Noway. About forty-five milch cows are generally kept, which, on an average, produce about 320 quarts *per diem*, which milk is sold fresh to the people about Sarpsborg and the saw mills on the Glommen. The ash, sycamore, horse chestnut, and larch trees, all attain to a good size on this favoured spot of Norwegian soil, which is calculated to remind one more of some parts of Yorkshire or Lancashire than Norway. On our return to Christiania, while waiting at Moss for the steamer, we strolled along the shore, and observed the littoral plants to be nearly the same as those that are found in Britain under similar circumstances. *Cakile maritima*, *Atriplex angustifolia*, *Geranium pratense*, and *Elymus arenarius*, were in abundance.

My friends having completed the necessary arrangements for their Lapland journey, we started from Christiania by rail to Eidsvold, forty-two English miles. On this line we passed a good deal of cultivated land, bere and rye, with potatoes, being the prevailing crops. The number of cattle seemed to be disproportionate to the state of the country, and their lean appearance betokened they had not been over well wintered. The Norwegian breed of cattle is something between the Ayrshire and Alderney, and they are both hardy and good milkers.

At Eidsvold we got the steamer which sails on the beautiful lake Miosen to Lillehammar, a distance of sixty-two English miles. To those who can relish the beautiful mixed with the sublime in nature, a sail on this lake is no ordinary treat. The scenery ever changing on both sides, now verdant with cultivated fields, and cattle grazing, again the rugged rocks rising to considerable elevations, and covered with dark towering pine forests, down to the edge of the water. The change of costume among the peasantry as they came on board and left occasionally at the little villages along the shores, was not less remarkable. They all appeared comfortably clad, though their garments in some instances were of a homely description.

It was near 12 o'clock at night before the boat reached Lillehammar, yet the landing-place was crowded with parties waiting the arrival of their friends, such as we frequently see in England at 12 o'clock, noon. At 6 o'clock next morning we commenced our journey up the beautiful and highly picturesque Gudsbrandsdalen, the first stage or two in a four-wheeled waggon machine, and the remainder on the singular carrioles of the country. Nothing can surpass the beauty of some parts of this extensive valley, shut in between lofty mountains, with those in the back ground covered with snow at the time we passed up. The scenery appeared to me intermediate with that which occurs in many parts of Switzerland and that of some deep highland glens in Scotland. The mountains not so lofty or so rugged as they are in the former case—more lofty and rugged than in the latter. Besides, many of the houses are perched high on the mountain sides, and, being all constructed of timber, they much resemble the Swiss chalets. The Norway maple (*Acer platanoides*) was first seen by us in its wild state, growing on the sides of this valley, where it becomes a large and handsome tree. The wayside plants were mostly of the subalpine type, and among them the following were conspicuous:—*Aconitum septentrionale, Cardamine amara, Geranium sanguineum, Geranium sylvaticum, Plantago media, Anchusa officinalis, Polygonum viviparum, Mainthemum bifolium, Linnea borealis, Vaccinium vitis Idæa, Vaccinium uliginosum, Struthiopteris Germanica,* &c., &c. In the evening we reached the station Viig, where we remained a day. On entering the room in the hotel, a bouquet of native flowers stood on the table, among which we observed *Astragalus alpinus, Androsace septentrionale, Asperugo procumbens, Galium boreale, Lychnis viscaria,* &c. Next day we rambled round the station, and ascended to the tops of some of the mountains. On this excursion the following, along with other plants, were collected:—*Astragalus alpinus,* very abundantly; *Menziezia cærulea, Arbutus alpinus, Cerastium alpinum, Saxifraga oppositifolia, Saxifraga cotyledon, Pyrola uniflora, Juncus trifidus, Juncus biglumis, Carex atrata, Carex Vahlii, Carex rupestris,* &c., &c.; *Woodsia hyperborea, Woodsia ilvensis, Equisetum scirpoides, Betula nana,* and *Salix Lapponica.* The tops of the mountains were in some places, covered with *Cetraria Islandica, Cetraria nivalis, Solorina crocea,* and *Nephroma arctica.* Among the mosses were *Hypnum abietinum* and *Orthotrichum speciosum.*

Next morning we continued our journey up the dale, passing at intervals some splendid scenery on both banks of the River Logen, until we reached Dombaas in the evening. The crops cultivated on the small farms were generally bere (bug) and potatoes, with occasional fields of rye. The hills on both sides of the valley were covered with forests of pines, chiefly Scotch fir, with birch. Here my friends and I made arrangements to part, they going down the beautiful Romsdale, and I up to the wild Dovrefjeld. Dombaas appeared to be a good station to remain at a few days for botanizing, which I would have done had time permitted it. After leaving this station, the greater part of the next on to Fokstuen is a steep ascent up the mountain road, which enabled me to botanize as I walked along, while the boy drove the carriole—*Pyrola uniflora, Pyrola secunda, Pedicularis flamea, Tofieldia borealis, Luzula spicata, Luzula hyperborea, Menziezia cærulea,* &c., were all very common by the road side, with the large racemes of *Aconitum septentrionale* among the trees and bushes. Fokstuen is about 3000 feet above sea level, which is stated to be the limit of Scotch fir, in Norway, though I saw them a good deal higher. Birch, with *Alnus incana*, and willows were now the principal shrubs and trees on to Jerkin, on the Dovrefjeld, 4000 feet above the sea level. At this station I remained ten days, and during that time I botanized over the mountain sides and valleys. On the Dovrefjeld, as far as Drivstuc, I was much too early for getting many plants in flower; for, although now the first week in July, nearly all the surrounding mountains and deep valleys were still covered with snow. The birch and willows were only expanding their leaves, so that I enjoyed two springs in the year 1863. It is, however, impossible for those who have not had experience of it, to form anything like a just conception of the rapidity at which vegetation advances in northern latitudes, after the snow is removed. No sooner is this winter covering gone, than the plants are in bloom; and with nearly constant light during the twenty-four hours, and a warm sun during the day, they get rapidly into seed, and thus go through their annual cycle much quicker than the same kinds of plants do in more southern climes. Close up to this mountain station, many of the rare alpine plants grew in profusion. *Arbutus alpina, Azalea procumbens, Menziezia cærulea, Primula farinosa, Primula stricta, Lychnis alpina, Cerastium alpinum, Viola biflora, Silene acaulis, Anemone vernalis, Potentilla opaca, Potentilla nivea, Thalictrum alpinum, Sibbaldia procumbens, Astragalus alpinus, Phaca alpina, Luzula spicata, Luzula hyperborea, Erigeron uniflorum, Erigeron alpina, Bartsia alpina, Pedicularis Lapponica, Pedicularis hirsuta, Juncus Hostii, Juncus trifidus, Juncus triglumis, Elyna spicata, Arenaria rubella*, with many more equally rare, were growing on this plateau of the mountain. The surface of the ground was in many places white with *Cetraria nivalis; Cetraria juniperina* and *Cetraria Islandica* were also very abundant, whilst every damp rock was more or less covered with Gyrophoræ. The dwarf birch (*Betula nana*), with rare alpine willows, covered large portions of the country, among which were *Salix lanata, Salix Lapponica, Salix reticulata, Salix polaris,* &c., &c. *Men-*

siezia cœrulea held the place the *Calluna vulgaris* holds on the mountains in Britain. I did not observe any Ferns at this elevation, but when I crossed over the mountain and got into the valley of the Driv River, *Cistoperis alpina* and *Cistoperis fragilis* were seen on rocks near the road side, along with *Saxifraga cernua, Saxifraga nivalis*, &c., &c.

But among the chief objects which I desired to obtain were *Cassiope hypnoides* and *Diapensia Lapponica*, both of which I knew grew somewhere on the Dovrefjeld. I therefore set about looking for them, and, after a good deal of wandering, had the pleasure to find both plants. The Diapensia grows on the tops and sides of some low hills between Jerkin and Kongsvold stations, in the direction of Schnœhattan, and also on the north side of that mountain. It was in fine flower on the 8th July, when I collected it, though the long winter covering of snow, under which it had lain from six to seven months, was only melting within a few yards of the plants. It grows among crumbling debris of rocks, sending down a long tap root, which makes it difficult to remove safely. It is also impatient of confinement in a package during the long land and sea journeys it is subjected to before it reaches Ireland, hence the reason it nearly always fails to grow in Britain! *Saxifraga cæspitosa, Draba androsace, Draba muricella, Draba nivalis, Draba alpina, Draba hirta, Arabis alpina, Ranunculus glacialis,* along with a number of Carici not in flower, and some of the plants already mentioned, were the principal phanerogamic kinds to be seen at this early period of the season for the Norwegian mountains. *Anemone vernalis* was very abundant; and on the top of a high mountain, at least 5500 feet high, I saw our common garden plant, *Epilobium angustifolium*, pushing its shoots through the thin covering of melting snow which still lay above it! I may here observe, that this, with *Potentilla argentea*, are two of the commonest plants in Norway. *Lycopodium annotinum*, with *Pyrola rotundifolia* and *Pyrola minor*, were also very common plants among the roots of *Betuta nana, Salix lanata*, and the other dwarf willows which are so abundant near Jerkin. I have not been able to name the collection of mosses and lichens yet, and therefore cannot state anything definite respecting them at present. Having thus made a rough examination of the plateau and accessible parts of the mountain on the Dovrefjeld, and collected a lot of living plants to bring to Glasnevin, I made preparations to return to Christiania, distant nearly 300 miles. Heavy or bulky luggage is a bane to travellers in Norway, it being next thing to an impossibility to get it conveyed on the small carrioles. There is no room or place for it on them, and whatever one carries must be tied on the back part of the vehicle with ropes by the traveller himself. Besides, this operation has to be repeated at the end of every seven or nine English miles, when the horse and carriole are changed, unless the latter be purchased or hired for the whole journey.

Being anxious to get my plants on as quickly as possible, I did not stay longer than I could avoid on the way, until I reached Christiania,

on the evening of the third day after I left Jerkin. Having then packed the plants, dried specimens, and other traps, in a good box, I sent them on to Hull by steamer.*

I now made preparations to continue my journey on to Sweden, and left Christiania by the steamer for Gottenberg. On this occasion the passage along the coast was made through the inner fiord, which gave us a good opportunity of seeing the numerous small islands we sailed among, calling at the different towns as they were reached, on to Fredrickstadt, near the entrance to the Christiania fiord, when we left the Norsk coast, and made way on to Gottenberg. The appearance of that town and environs differed considerably from any I had seen in Norway—the houses being mostly built with stone or brick, and some handsome structures among them. The pretty walks and drives through a large park-like piece of pleasure-ground, are well laid out and neatly kept. The elm and other trees attain to a large size, and the land is rich and fertile, producing heavy crops of rye, wheat, oats, meadow, &c. Altogether, Gottenberg bears much resemblance to a well-to-do, thriving English town. I only remained in it part of a day, when I passed on by rail to Stockholm. The line leads through some good agricultural country, and also through a good deal of forest. Judging from what can be seen from the windows of a railroad carriage, the ground for the most part appeared to be sandy and light; the crops being chiefly rye, oats, barley, and some wheat. The farm houses seemed comfortable, with clean exteriors, all the way through. On reaching Stockholm, I learned that the Association of Scandinavian Naturalists, with other scientific bodies, were holding their meeting there that week, in like manner to our British Association. Having several letters of introduction to some of the members, I presented them on the following morning, after the day I arrived, when I was kindly received. The President of the Medical Section directed me to Professor Andersson, of the Natural History Section, to whom I had a letter also. This gentleman told me my name was recorded on the list since the first day of meeting, by Dr. T. Fries, of Upsala, to whom I wrote before I left Ireland, informing him of my intention to visit Stockholm about that time. He further invited me to join them, as the members were all going to Upsala on the following day, which would afford me an excellent opportunity to see everything connected with the town and university there, which I gladly availed myself of. After the business of the day had

---

* The sort of fence in general use along the road sides is of a peculiar kind, differing from what is generally in use for that purpose in middle Europe. It consists of spruce fir trees, split up roughly into triangular pieces, which are placed at about an angle of 45°, with one end sunk slightly in the ground, and so close as to prevent hogs or lambs from getting through them. The whole is then bound with two or three lines of withes, of twisted spruce, fir, birch, or willows, at certain heights from the ground; and in this way a formidable fence is constructed, difficult to get over, as well as sufficiently open to permit the snow to blow through it.

been transacted, and the members of the Association had dined together, a steamboat was in readiness to convey them to Upsala, where the whole of the members were specially invited by the heads of the university and townspeople. The evening was fine, and the sail up the beautiful Malar Lake delightful. The numerous rocky islands we passed on the way were in most instances covered with dense forests of pines, birch, and willows, to the water's edge, though a good deal of agricultural country was also seen at intervals.

From the time we started until we returned again to Stockholm, everything was done that could be done by the gentlemen in charge of the excursion, to make the party happy and comfortable. Before landing we were all served with tickets numbered, when according with the numbers we were called on shore, and there handed over to parties who had carriages ready to convey us to our lodgings, where board was also provided free of charge, with the families who received us into their houses.

Knowing the great banquet to be given by the university would take place early on the following day, I considered I would see very little of Upsala unless I started early, which I accordingly did, and went at once to the Botanic Garden. There they were all busy preparing for the dinner, which was to be held in the large conservatory. I had consequently an opportunity for looking through the collection alone at my leisure, the doors of all the conservatories being open. I felt here as if standing on hallowed ground, every thing about me being almost sacred to the memory of the immortal Linnæus; but time changes all things, as it has also done with the celebrated system of botanical classification of this great man, even at the very seat of learning and botanical garden where it was first promulgated by the author. The plants are now arranged in natural families, according with the modern system. The garden is divided into squares by hedges of spruce fir and whitethorn, and in each square portions of the herbaceous collection are cultivated; the ground and climate appeared to answer them, and I observed a good many rare species which are seldom seen in English gardens. The range of conservatories is rather extensive, but the houses were almost empty at the time I visited, the greater part of the plants being then placed out of doors: they appeared to consist mostly of South African and Australian kinds, and contained among them probably more which are enumerated in the "Genera et Species Plantarum" of Linnæus than are to be found in any other collection. There were also a number of Mexican and other modern plants; but, like most botanical gardens, the collection cultivated is too large for the accommodation afforded, which prevents the individuals composing it from being grown into good specimens. Melocacti and Mamillarias were pretty numerous, and in good health. I never before saw so many species of them in flower at one time as happened to be there when I visited that garden. The Orangery, as it is called, is a long glazed structure, which affords shelter in winter for most of the large plants in tubs and pots; it is

about thirty feet high, with side shelves, on which the plants are arranged in three tiers, the one above the other when it is filled; one very old *Cereus hexagonus* reached nearly to the top of it, and is a most remarkable specimen of the plant. On this occasion there was neither time nor opportunity for seeing any of the valuable herbaria. Dr. T. Fries showed me some of his lichens, and kindly presented me with a set of his North Cape species. In front of the Orangery, leading to the door of the lecture room, is a large open space kept in short grass, which extends through the centre of the garden; on each side spruce fir trees are standing, which are cut in square forms, and have rather an ornamental appearance; there are also some handsome young specimens of the same kind of tree growing dispersed through the garden, which make tolerably good substitutes for our Thujas and ornamental evergreen shrubs, which are too tender to survive the winters at Upsala. In a covered passage leading to the lecture room a beautiful statue of Linnæus is placed, representing him studying a plant of *Linnea borealis*. The statue was presented by the students of the university, and has the following inscription under it:—"Carlo A. Linne, Juventus Academiæ Upsalensis, Anno MDCCCXXII." I also visited the house where Linnæus resided, and which is still in good preservation, with the remains of the old Botanic Garden near it; his last resting-place in the splendid old cathedral is generally pointed out to strangers who visit Upsala, but on this occasion, when so many naturalists were present, it became an object of more than ordinary interest, and was visited by many. Manuscripts of some of his lectures were lying on the table in the grand library, which were written in Latin. Along with the English party, under the guidance of Admiral von Leader, I had an opportunity of visiting Old Upsala, so famous in the early history of Scandinavia, when human sacrifices were offered to propitiate their false deities Odin and Thor. On ascending to the top of one of the remarkable tumuli which are there, the customary practice of drinking mead out of an ancient drinking horn had to be gone through, after which we returned to the Botanic Garden, in time to be present at the dinner. I need only say this was on a scale of magnificence I have rarely seen equalled on such occasions, and nothing could exceed the attention and kind welcome accorded to the strangers present. The Rector of the University made the first speech, and was followed by Mr. Hamilton, the Governor of Upsala, on behalf of the King. Professors Steenstrup, Vanderhæven, and Sandahl each addressed the company, and, lastly, old Dr. Fries was called for, who, after concluding, was carried round the large assemblage of people present, shoulder high, in an arm chair. The time for leaving Upsala had now arrived, and, headed by the musicians, we marched from the garden to the steam boat, where we took leave of our kind entertainers, and sailed for Stockholm, arriving there late at night. Next day I visited the Haga, Royal Park, and also the Deer Park, both of which are favourite places of resort with the inhabitants of Stockholm. When at the former place I went to the Royal Gardens there,

which are under the superintendence of M. Ericsson, whom I was not fortunate enough to find at home. At this establishment there is a long range of forcing-houses, but not erected on a good plan to suit the purposes for which they are intended, though crops of average quality of both grapes and peaches were growing in them. The conservatories contained a large assortment of camellias, and other flowering plants; the gooseberry and other small fruits, as well as apples and pears, ripen, but it is rather cold for peaches and nectarines out of doors. The market of Stockholm was well supplied with white heart and other kinds of cherries, of excellent quality, which I fancy must have been brought there from a more southern latitude. Many of the ordinary deciduous trees which we are accustomed to see in England attain to moderately large sizes at Stockholm, particularly elm, which is frequent there. The Deer Park is well laid out, and planted with different kinds of trees; the walks and drives through it are extensive and pretty well kept. Having seen as much as I could of this remarkable city and its environs during the short time I could devote to it, I took passage by the steamer to Ystad, which is between 300 and 400 miles distant. The beauty of the scenery after leaving Stockholm by this route has been so frequently described by travellers and in guide books, that I shall not attempt to add to the descriptions already given of it, further than to express an opinion that, without seeing it, it is impossible to form anything like an adequate idea of it. After reaching Ystad I had a few hours to wait until the post coach started for Malmo, which I employed botanizing along the shores of the Baltic Sea. A very large number of our common British plants are equally common there, and among the rarer kinds I picked up the following: *Illecebrum verticillatum*, *Centunculus minimus*, *Lepidium ruderale*, *Apera spica venti*, and *Corynephorus canescens.*

From Ystad to Malmo (forty English miles), one of the most fertile provinces of Sweden is passed through. The crops of rye, wheat, barley, and potatoes, were all of the finest description. Fruit trees are also common here near the farm houses. At Malmo I had only a short time to remain when I got the steamboat to Copenhagen. Soon after my arrival there I made my way to the Botanic Garden, which is nearly in the centre of the city. I carried a note of introduction to the superintendent, M. Agust Weilbach, which I got from Professor Asæmted, whom I met at Upsala. The former gentleman received me with much kindness, and took great pains to show me the garden and fine library. I found a good collection of plants cultivated here, such as are well adapted for teaching purposes, and also many rare ornamental kinds. The conservatories are placed apart from each other, but if connected would make a good range. The principal one is a low palm house, wherein a considerable number of species are cultivated, along with some good Zamias. I was much interested with one plant I observed there that I had not previously seen, which was named *Dioon imbricatum.* It differs considerably from the *Dioon edule*, and, as M. Weilbach showed me, par-

ticularly in the fruits preserved in the museum there, which are much larger than those of the latter, though of same sex. They may, however, only be varieties of one species. Another stove contained Orchids and Ferns, among which there were some good specimens, as well as some scarce sorts. Several other small houses for growing South African and Australian plants in during the winter, were filled with flowering annuals, &c., at the time I saw them. The arrangement of herbaceous plants is according to Endlicher's system, and his numbers are attached to the plants. They are divided into general collection, medical collection, and indigenous collection.

Among the latter I observed some interesting species, such as *Psamma Baltica*, *Iris spuria*, *Sturmia Læseli*, and *Herminum monorchis*. The botanical library is in the garden and contains a rich collection of books on the science, comprising all the modern standard works, as well as those of the older authors. Some numbers of the new edition of "Flora Danica" were lying on the table, in which the plates appeared to be beautifully and faithfully executed. Many more of our hardy trees stand the winters in Denmark than do in Norway and Sweden. *Diospyrus lotus* flowers and ripens fruits in the botanic garden; *Platanus orientalis* and several species of *Juglans* also grow freely there. At the palace and gardens of Rosenberg there are very large trees of horse chestnuts, purple beech, walnut, and other deciduous kinds. Among the ornamental shrubs several kinds of Robinias, Loniceras, Roses, Spiræas, and on a wall *Wistaria Sinensis* was flowering freely. The trees near the esplanade, and on the ramparts round the city walls, consist chiefly of horse chestnuts, elms, sycamore, and walnuts, *Juglans regia*. They are planted in lines on both sides of the broad walks, where in summer they afford pleasant shade, as well as shelter from showers, to the inhabitants of Copenhagen, who so much frequent them. I observed symptoms of considerable improvements in the way of ornamental planting both in the city and suburbs. In front of the large palace, Charlottenberg, a good deal has already been done, and also in many places outside the city gates. Having seen the principal museums, &c., I left Copenhagen by rail for Korsor. The appearance of the country along this line is altogether different from Norway or Sweden. Pine-covered rocky hills are no longer seen, but in place of them extensive forests of beech and oak are of frequent occurrence. The country is flat, and the land heavy and fertile. Rye, oats, wheat, and barley, were the principal white crops, but meadow and potatoes were also in fair proportion. They all appeared to be good, particularly the meadow, which on the 23rd of July was mostly cut and saved. I observed the cows were not allowed to graze at large over the fields, but were tied separately in a line, and thus compelled to eat down the grass, crops of vetches, &c., as they gradually were advanced. At Korsor I had several hours to wait for the steamer to Kiel, which enabled me to get another botanizing stroll along the shores of the Baltic, but I did not observe many plants which are rare in England. *Lysimachia nu-*

mularia was most abundant on the damp bottoms of fields, which in spots were yellow with its numerous flowers. From Kiel to Hamburgh, the general aspect of the country, and the crops grown, bear a great resemblance to English scenery, only that fields of buckwheat are not so common in the latter country as they are in Schleswig Holstein. I happened to reach Hamburgh at the time of the great international exhibition of cattle, farm produce, and agricultural implements, which I was fortunate in seeing. I then went to the Botanic Garden, which is one of the best and most beautiful of all the Continental gardens. M. Otto, the inspector, continues to improve it steadily, adding largely to the collection as he goes on. He keeps good pace with the spirit of the age, in combining large masses of ornamental flowering plants with the botanical arrangements. Having already on a former occasion given a brief general description of this establishment, I shall not notice it further at present, than to mention a few plants of which there are good specimens to be seen there. Of Ferns, *Lophosoria Deckeriana*, *Alsophila Humboldti*, *Hemitilia Klotchiana*, are fine. The Nymphæas in the Victoria water-lily house were also in great health, and flowering profusely. *Begonia dædalea*, *Begonia smaragdinum*, *Alocasia metallica* (*Schott*), *Caladium marmoratum*, and *Caladium Dallisi*, were all new plants to my eyes. A new species of Phormium, supposed to be introduced for the first time to Europe, was pointed out, namely *Phormium Cooki*, which M. Otto has raised a number of plants of from seeds brought to him from New Zealand. It has much narrower and longer leaves than those of *Phormium tenax*. I can hardly close my note on this place without noticing the new Zoological Garden at Hamburgh, which is nearly finished, and bids fair to rival even the famous London garden. It certainly does so in extent, beauty of landscape, and contrivances for the preservation and comfort of the animals; but it will take time and much money to get anything equal to the collection of animals which have, by great perseverance, been brought together at London. I also paid another visit to the Messrs. Booth's famous nurseries at Flotbecker, where a considerable change has taken place in the collection since I last saw it, five years ago. The stove plants there are not so numerous now as they were then, but their appearance is more imposing, in consequence of so many of the fine foliaged kinds having now grown to large specimens. The collection of Echinocacti and Mamillarias is exceedingly fine and well grown. Among the hardy trees I noticed *Broussonetia papyrifera fol. variegata*, *Acer pseudoplatanus fol. purpurea*, *Juglans regia laciniata*, *Acer dissecta*, *Prunus virginica splendens*, *Æsculus heterophyllus dissecta*, *Caragana Gerardi*, *Platanus integrifolia*, *Tilia Europea variegata*, *Acer tricolor*, and *Acer dasycarpa*, all of which are good ornamental hardy trees.

My next stage was Hanover, where I went to see the fine collection of Palms which are cultivated there, probably the best in Europe at the present time. The magnificent specimen of *Corypha australis*, having reached to the top of the palm house, forty feet high, has been sunk

about six feet in the ground, below the level of the floor. This has been effected in a manner which rather adds to the beauty of the plant than otherwise. The pit has been nicely sloped round its edges, and planted with Lycopods and Ferns, which have a pretty appearance when looked down on. The great *desideratum* in this garden is space to grow the many fine specimens of Palms properly, which are now suffering by being so crowded. A number of the rarer sorts are cultivated in smaller houses, in which a higher temperature is kept up.

The *Mauritias*, and others which are found difficult to cultivate by most growers of them, thrive well at Herrenhausen, when subjected to M. Wendland's treatment, i. e., standing the pots in which they are growing in pans of water. From Hanover I passed on by Cologne to Brussels, where I went to see M. Linden's novelties, &c. This extensive collection differs in general aspect from that of any other I know of, not only in being so rich in newly introduced plants but especially, in the great number of kinds of Tree Ferns and Palms which are cultivated there. The collection of Orchids is also good, and comprises some very scarce sorts. *Vanda Guiberti*, *Saccolabium Japonicum*, *Dendrobium*, *quadricolor*, *Cypripedium caudatum roseum*, and *Uropedium Lindeni*, were all in good condition. Among the Ferns, *Cyathea excelsa*, *Cyathea Beirichiana*, *Blechnum Rio Grandense*, *Alsophila elegans*, *Alsophila denticulata*, *Alsophila contaminans*, *Alsophila gigantea*, *Alsophila Schiediana*, *Doryopteris alcyonis*, and *Asplenium myriophyllum*, were conspicuous. *Rhopala glaucophylla*, *Rhopala crenata*, *Crescentia regalis*, *Crescentia nigripes*, *Erythroxylon coca*, *Purdia nutans*, *Oreopanax dactylifolia*, *Weinmannia incisa*, *Sinclairia violacea*, *Dioscorea anœctochilus*, *Echites argyrea*, *Geisomeria marmorea*, *Alocasia Singaporensis*, *Phrynium punicea*, *Maranta membranacea*, *Frecynetia Banksii*, *Pandanus blancoi*, and the pretty *Libonia floribunda*, covered with red and yellow flowers, are some of the more remarkable plants to be seen in the general collection. After taking leave of M. Linden, I came on to Ghent, and first called on my friend, M. Louis Van Houtte, whose extensive establishment is so well known in England. The Camellias, Azaleas, and Rhododendrons, for which this nursery is so famous, appeared all in excellent health, and well set with flower buds. *Cypripedium superbum*, *Vriesia psittacina*, *Naegelia amabalis*, *Phyllagathus rotundifolia*, *Ataccia pinnatifida*, *Pandanus caricosus*, *Pandanus reflexus*, *Pandanus furcatus*, *Dracæna Ehrenbergii*, *Dracæna concinna*, *Alsophila obtusa*, *Alsophila infesta*, *Alsophila inermis*, and *Cibotium princeps*, were all in fine examples, along with some splendid palms, and other rare ornamental stove and greenhouse plants. I had only time to make a hasty call at M. A. Verchaffelt's nursery, before leaving Ghent. In that establishment there are, as usual, many fine and valuable plants cultivated, particularly palms. *Lantana aurea*, *Calamus Verschaffelti*, *Stephensonia grandifolia*, *Pinanga maculata*, *Chamærops rubra extra rubra*, and *Pandanus elegantissimus*, are all in considerable quantities there, though so scarce elsewhere. It was with regret I had to leave without seeing the

nurseries of M. Van Geert, which are now out of the town. The nurseries of M. Stelzner and Co. I had also intended to visit; but being compelled to leave for Calais by the afternoon train, I could not accomplish it. I reached London on the following morning, where I remained a few days visiting my friends at their respective establishments, who enabled me to add largely to the long list of donations received at Glasnevin during the present year.

NOTE.—*The names of plants quoted are those they bear in the respective establishments mentioned, and are given here without alteration to facilitate communications.*—D. M.

XIX.—*Suggestions for Improving the Diet of the Irish Labourer.* By E. D. MAPOTHER, M.D., Fellow and Demonstrator, Royal College of Surgeons, and Surgeon to St. Vincent's Hospital, Dublin.

[Read November 16, 1863.]

THE food of which a nation partakes influences so powerfully the health, prosperity, and physical and mental powers of its individuals, that I have thought a few remarks on the diet of our countrymen, and the information which I hope they may elicit during their discussion, might be productive of good. Before those direful years, 1845–46–47, when distress, perhaps unequalled in the world's history, prevailed over the island, the potato was almost the sole support of our agricultural population; and probably no other food could have been produced in sufficient quantity to feed the then over-abundant population, at least by the modes of culture then in practice; besides, the extremely subdivided state of the land left the cottier so small a patch, that potatoes alone produced from it could support his family, and daily employment was not to be had by which he could earn money to procure better food. Sir George Nicholls, in his report on the condition of the peasantry in 1836, says:—"Land is to them the great necessary of life; there is no hiring of servants; a man cannot obtain his living as a day labourer; he must get possession of a plot of land to raise potatoes, or starve." A few weeks' exertion in planting, digging, and pitting the potatoes would suffice to procure the means of subsistence for the year; and with so little muscular labour and consequent waste of tissue, so poor a food would support life at this "zero" of comfort. However, the poorest tenant was likewise able to obtain milk, butter, or eggs, and they well knew the value of the latter aliment. I have often heard them remark, "You could put nothing so good and wholesome in an egg-shell as was in it." Those who had not new milk were always able to get buttermilk from the neighbouring farmers, and the casein of this fluid was a

most beneficial addition to their potatoes. Whiskey also—for the most part of the illicit variety—was very plentifully used, as it could be had for about a penny a glass, and the waste of tissue was thus considerably arrested. It is thus that the fact of a nation living almost exclusively upon one food, and that food so insufficient in the nitrogenous element —a matter which has always excited the wonder of German chemists—can be explained.

The condition of the Irish agricultural labourer is now altered in many respects for the better. That this amelioration has not yet extended to his food I will presently endeavour to show. The population has been thinned by famine, its attendant diseases, and by emigration, to so amazing an amount, that the Census Commissioners of 1851 estimate the loss from 1841 to 1851 at 2,496,414; and these figures would be more startling if we could confine the calculation to the years which immediately succeeded the famine. By the report of the commissioners, lately issued, we find the loss between 1851 and 1861 to have been 753,418; and emigration is now stated to be proceeding at the rate of 1300 per week. Owing to this diminution, the increase of employment, and other causes, the cottier system has been supplanted by one in which the peasant earns his support by his daily labour, and for this increase of physical exertion an increase of nitrogenized food is needed. By my own observation, and by replies to a circular issued to dispensary medical officers, I have ascertained that in many parts of the country the potato, as long as it lasts, is still the staple food, very variable proportions of Indian meal, wholemeal, or white wheaten bread being added. Tea has been substituted for whiskey; and although the blessings of this change are inestimable, it cannot be doubted that alcohol more powerfully prevented the waste of tissue, and that, therefore, the diet should be proportionally improved. Good nitrogenized food, especially animal food, gives the greatest and most practical support to temperance; but the condition of a people deprived of both must be necessarily wretched and cheerless. It is for want of oily and nitrogenized food, which should be supplied by milk, that infant mortality is so astounding, and that scrofula in its many forms is so rife amongst the poor of this country.

The faults of the potato as an extensive article of human food have been so often expatiated upon, that I fear I shall be deemed tiresome if I allude to them; but it is notorious that principles of public health require repeated reiteration before they achieve any practical reform. The value of any aliment is pretty nearly proportional to its similarity in chemical composition with the blood which it is destined to form; and, judged by this test, the potato makes a sorry figure. Their composition, in 100 parts, is compared in the following table:—

	Blood.	Potatoes.
Nitrogenized or flesh-producing matter, ...	20·00	1·6
Unnitrogenized or heat-producing matter, . . .	00·15	22·83
Saline matter, ...	00·68	1 56

It will be readily seen that the heat-producing element, or the starch, is out of all due proportion, especially as the mean temperature of this climate is but 51 degrees. I have no doubt but that this over-abundant supply of starchy material is a principal cause of the great prevalence of rheumatic diseases among the inhabitants of this country; for they are owing to some acid (in my opinion probably carbonic), which such food produces in the blood, and which is prevented from being eliminated through the skin by the great humidity of the atmosphere. The great size of the starch grain renders its conversion into sugar difficult. The amount of gluten, or flesh-producing material, is so small as to be quite unable to keep up a high degree of physical strength and energy. The Hindoos and the inhabitants of tropical America subsist respectively on rice and the plantain, substances which bear the most striking similarity in composition to the potato; and were it not for the loftier impress the Creator has stamped on the Caucasian race, the ennobling influence of Christianity and civilization, and the mental vivacity of the Irish people, I cannot help believing that our poor countrymen would in time, from similarity of food, sink to as low a level in the human scale. The amount of labour each of these races is capable of performing is most strictly in proportion to the amount of nutritive matter in their national diet.

It has been calculated that a healthy labouring man should be supplied daily with such an amount of food as shall contain 5500 grains of carbon, and 125 grains of nitrogen; and Dr. Letheby, the officer of health for the city of London, states that these are contained in about 12 oz. of beef, 20 oz. of bread, and ½ an oz. of butter. This food, besides being expended in maintaining the never-ceasing vital processes of the body, is capable of supporting an amount of muscular work equivalent to the raising of about 3 millions of pounds to the height of one foot. I am aware such theoretical estimates must be controlled by practice; for aliments differ widely in digestibility, cohesion, mechanical state, &c., as well as in chemical composition; but what a vast amount of potatoes should be consumed to afford the due quantity of nitrogen! From 8 to 12 lbs. of potatoes was the average allowance to each labourer; and this great bulk produced such a distention of the stomach and other digestive organs, that they came to resemble those of a pure vegetable-feeding animal; whereas man's teeth and digestive organs indicate that he was destined to live on a far different kind of food. The bulk of the potatoes has been also found a serious obstacle to their carriage to any locality where scarcity should arise. The introduction of flesh-producing food into the blood tends to the removal of the effete or worn-out materials, and thus may be explained the frequency and fatality of fever and other contagious diseases among the poorer classes; for it is upon these effete products these fevers are fed. I have no doubt but that examination of the blood of the Irish poor would show fibrin, which is one of these waste products, to be more abundant than in that of other races. When famine still further reduces the supply of nitrogenized food, fever becomes rife, as was admirably shown in Dr. Corrigan's famous pamphlet,

entitled, "Famine and Fever as Cause and Effect in Ireland." He proved that for the previous 100 years epidemics of fever followed invariably on years of scarcity, and thus gave a useful warning previous to the destructive epidemic of 1846 and subsequent years. As regards the potato, he forcibly remarks—"The potato has, I believe, been a curse to our country. It has reduced the wages of the labourers to the very smallest pittance; and when a bad crop occurs, there is no descent for them in the scale of food: the next step is starvation."

Scrofula and consumption are blights to which we are more subject than most other countries; and there is every reason to suppose that this proclivity is due in great part to the national food, either through its insufficiency in nitrogenized or superabundance in hydrocarbonaceous elements. Consumption does not exist among flesh-eating or fat-eating nations.

The New Zealanders are most frequently attacked by scrofulous diseases since Captain Cook substituted the potato for fish and pig's flesh, their former food. The ash of the potato is most remarkably poor in lime and magnesia, materials of the first importance in building up the framework of the body; and this may account for the considerable frequency of rickets, a disease of the bones produced by their deficiency. The water being strongly impregnated with lime may obviate this in some districts. It is a well-known fact that the cornea or transparent coat of the eye is apt to become destroyed if food of a varied character, or containing a due proportion of nitrogen, be not supplied. This is accounted for by the fact that that structure contains a large amount of nitrogen, and is not very freely supplied with blood. Nearly all intelligent travellers acquainted with the influence of food upon health have urged strongly that the dietaries of the Irish poorhouses are too unvaried, although not deficient in quantity, and the frequency of ophthalmia seems due in great part to this fault. All the remarks which I shall make upon the improvement of diet would apply to that of poorhouses; and here I must express my surprise that the potato, which, with all its faults, is a valuable antiscorbutic, is wholly excluded from the regular meals of their inmates.

By the report of the Census Commissioners, just issued, we learn that there are 3149 blind males and 3730 blind females, or 1 in every 843 of the population. In 1851, the proportion was but 1 in 864. The inferiority of the food of females, and the depreciation of the food of the poor in general, go far to explain these figures. In Norway the food is very poor in nitrogen, and the proportion of blind is 1 in 540. In the United States it is superior, and the ratio is but 1 in 2489.

Another reason why little reliance can be placed on the potato as a national food is, that it has frequently failed, producing in 1739, 1821, 1831–5–6–7–9, 1845–6–7, and every year since, more or less, the most calamitous results. In fact, owing to the humidity of the climate, which seems every year to be increasing, and perhaps some other causes, the soil of Ireland is becoming less suitable for the growth of this tuber. Mr.

Coulter, the special correspondent of the *Saunders' News-Letter*, informs us that in the parish of Kilnoe, Scariff, but 200 stones of potatoes were produced per acre last year, where 1500 was an average crop some years back. The potato, too, keeps so badly, that it is only available as food for ten months in the year, and the surplus produce of an abundant year cannot be preserved for one of scarcity. It has depressed the prosperity of other places besides our isle, as, for instance, Somersetshire and Devonshire, which, some years back, were remarkable for a wretched peasantry, living almost exclusively on this root of much evil.

The advantages of an improved dietary are apparent. It has been long remarked that Irishmen, when fed by rations, are capable of performing the duties of soldiers, seamen, or labourers with physical power far above that which the wretched food at home enables them to do. It is also certain that better food would substitute mental energy for the apathy often miscalled contentment, which so often afflicts our poor countrymen. In appealing for more attention to the wants of the labouring class, in a paper read before the Social Science Congress of 1861, the Rev. William Hickey forcibly exclaims—"How long will the agriculturist, who selects with care the best specimens of cattle, horses, and sheep, for propagating their kinds, and feeds all his live stock even to repletion, continue to disregard the importance of providing amply for the sustenance of the human beings in his employment?" The industrial, naval, and military greatness of England depends chiefly upon the excellence of the food of her population. Sir Charles Fox, the eminent contractor, states that, after employing vast numbers of workmen in various parts of the world, he always obtained more labour out of the Englishman, because he was better fed; and, although his wages were the highest, it was most profitable to employ him. I have been informed of a very striking instance of the effect of better food in improving the physical power of labourers. When Greek sailors, previously fed on maccaroni, fruits, and oil, come to our quays with corn vessels, they are remarkably bad labourers; but accordingly as they improve their diet, which the high wages they obtain while in port enables them to do, their labour becomes immensely more valuable.

Our countrymen who work for hire in the United States are admirable labourers. They receive high wages, as the sums they send home to their relations testify, and fare right well, as will appear from the following *menu*, which a gentleman who farmed for many years in Pennsylvania told me he daily adopted:—Breakfast at 5 A. M.—tea, and coffee, fried pork or mutton, pork sausages, curds sweetened, buckwheat cakes with syrup, fried potatoes and onions, and sour kraut. Luncheon at 10, consisting of fruit pies, to which was generally added a pretty free stoup of rye whiskey. The dinner at 12, and the supper at 5, were much the same as breakfast, save that there was more meat at the former, and more pies at the latter.

When employment is so profitable, and food so good abroad, statesmen will find it difficult to check the present exodus—deplorable and

disastrous to the future of our country as it must prove—without taking steps to improve the dietary of her people, or instituting employment by which they can obtain means to procure better food.

As there is no safer guide in estimating the value of foods, when modifying circumstances are duly considered, than chemical analysis, I have appended the following

Table of the Nutritive Value of Food per Cent.

	Nitrogenized.	Starchy.	Fat.	Salts.	Water.
Arrow-root, . . .	. .	82	. .	. .	18
Potatoes, ...	2·0	28	0·2	0·7	74
Cow's Milk, . . .	4·5	5	4·1	0·7	86
Rice,.	7·0	76	0·3	0·3	14
Indian Meal, . .	9·0	65	8·0	1·7	14
Wheat Flour, . .	11·0	70	2·0	1·7	15
Oatmeal, ...	12·0	62	6·0	3·0	15
Eggs, ...	14·0	. .	10·5	1·5	74
Beef, ...	19·0	. .	5·0	2·0	73
Peas, ...	22·0	58	2·0	3·0	13
Beans, ...	24·0	44	1·4	3·6	14
Lentils,.	29·0	44	1·5	2·3	14

I shall now proceed to allude to a few of these in detail, which I believe might be very advantageously used in greater quantity than at present, premising that a dry, nitrogenized food seems suitable for the circumstances of Ireland, as, the temperature being moderate, no great abundance of heat-producing food is needed, and as the great humidity of the atmosphere prevents much loss of water by the skin.

In those countries where the supply of animal food is over-abundant, it is of great importance that the surplus should be preserved, and exported for consumption in other countries. Thus, in Monte Video and other districts of South America, vast numbers of cattle are slain, and the choicest parts of the animals' flesh are cut in thin flakes, dipped in brine, and then dried in the sun. This tasajo, or jerked beef, has been used for many years as food for the negroes; but of late, owing to the American wars, it has not reached that market. The authorities of Monte Video have, therefore, exported this jerked beef in great quantities to the British ports. Mr. Gilmour, the consul at Glasgow for the Republic, has, at the suggestion of Professor Archer, the director of the Industrial Museum of Scotland, had forwarded to me a large quantity of the beef, specimens of which I submit. When steeped in water, it increases three times in thickness and weight. It is not expected to supersede the use of flesh meat with those who can afford it; but I am convinced no greater boon has been offered for many years to the poor and labouring classes in this country. It sells at 3*d.* a pound, or 2½*d.* if large quantities are purchased. With the invaluable aid of Pro-

fessor Galloway, of the Museum of Irish Industry, I have submitted it to analysis, as well as averaged samples of corned beef prepared in this city, and I subjoin the comparative results :—

	Monte Video Beef.	Corned Beef.
Water,	17·94	62·08
Ash,	21·66	9·97
Fat,	3·05	21·07
Nitrogenized substances,	57·35*	6·88†
	100·00	100·00

The amount of fat in each is not astonishing, when it is remembered that one animal enjoyed free exercise—the other was stall fed.

I am informed that an employer in Belfast is testing its value in the feeding of 1500 workmen; but the only way in which it will find its way to the homes of the poor is by giving them an opportunity of tasting it cooked in the best methods. This was accomplished by a working men's free supper in Edinburgh; and the agent has authorized me to announce that he would supply the beef for a similar meeting, if organized in this city.

The only method of cooking which I will detail, from the directions of the Monte Video commissioners, is the following, as I can from personal experience vouch for its producing a wholesome and palatable dish :—After steeping the beef in water, to which soda is added in the proportion of one ounce to the gallon, changed three or four times, for three hours, take a sufficient quantity of the meat, according to the size of the dish required, and cut it into small pieces; take an equal quantity of potatoes, and peel and wash them; put them into a clean saucepan, and cover them with water, and let them stew over a slow fire (adding pepper, salt, chopped onions, &c.), until well cooked, in the same manner as when making Irish stew.

From the great heat of the climate, the beef cannot be saved in thick masses; and as some of the savoury and volatile materials of the meat are lost by cutting it in thin slices, I have suggested that Professor Morgan's patented plan of salting by injection be adopted, especially as the beef killed in summer is very superior. It might be also economically and commercially advantageous to reduce the beef to the form of extract before exportation. The extract of beef contains all the nutritive portions of the meat, and, from its soluble and concentrated state, is the most powerful restorative the physician can employ. It can be best made, as Liebig directs, by boiling the meat, chopped fine, in eight times its weight of water, straining, and evaporating the solution in a water bath to a soft, but solid state. Such a product would cost about 8*s*. a pound in this country, but should be obtained for one third that

* Containing 7·67 Nitrogen, = 49·80 Fibrin.
† " 0·49 " = 3·18 "

sum in Monte Video. The addition of a little hydrochloric acid would dissolve the flesh more completely.

The tribe of plants which far excel all others in the amount of nitrogenized matter they produce is the Leguminosæ. Their seeds have been used for many centuries by the inhabitants of Central Europe, Asia, Africa, and Australia; and how perfect a support they afford is attested in Holy Writ. In the Book of Daniel we read that the Hebrews were supported upon pulse and water, "and after ten days their faces appeared fairer and fatter than all the children that ate of the king's meat." Herodotus tells us, too, that lentils formed the food of the labourers who built the Pyramids. The following analyses by Payen exhibit the composition of peas,—firstly, gathered green, and then dried; and, secondly, those gathered when dry:—

	Peas dried green.	Dry ripe Peas.
Starchy matter,	58·5	58·7
Nitrogenized matter,	25·4	23·8
Fatty matter,	2·0	2·1
Cellulose,	1·9	3·5
Salts,	2·5	2·1
Water,	9·7	9·8
	100·0	100·0

Their superiority in composition, and greater solubility in water, when pulled green, suggest that that plan should be adopted, especially as the ground is thus left in July ready for another crop, and insects cannot damage the return. The starchy matter then is sufficiently abundant, and the nitrogenized substance exists in great quantity, and is, moreover, of the most excellent quality, being legumin, which is identical with the casein of milk, and therefore of all aliments the most soluble and most natural. Their nitrogenous element is so abundant that one pound of peas must form as much muscle as fifteen pounds of potatoes. Legumin, with lime, forms a hard, insoluble, and rather indigestible compound; and it is well known that in this way peas boiled in hard water are not very quickly or very comfortably digested, but the addition of a little soda, or the substitution of river or, still better, rain water, in which they should be steeped for a few hours, removes this objection. However, moderate slowness of digestion is not an objection to an aliment for a working man, as hunger then more slowly returns in the intervals of his meals. The Scotch often use the pea-meal simply mixed up with boiling water,—a mess they call "brose." During a recent visit to the neighbourhood of Mr. Allan Pollok's vast property in the county of Galway, I was informed that his labourers, especially during harvest time—the season of greatest muscular exertion—were fed upon pease porridge, and the only objection I heard offered to it was "that it was very stuffing, and that it was a long time before appetite returned." This was a complaint which I wish our half-fed peasantry were able to make; and at any rate it could be easily removed by diminishing the proportion of peas to other

food. The highly nutritious value of the pea has been long recognised in China, where they manufacture most excellent cheese from it. Under the name of tao-foo it is hawked through the streets of their cities, and consumed in great quantities. They make it by steeping, boiling, grinding, and dissolving the peas in water. The vegetable casein is precipitated by gypsum, and is then salted and pressed into moulds. The sandy, gravelly, and calcareous soil of many parts of Ireland is very fit for the growth of peas, which, moreover, require no manuring if seeds, and not abundant straw, be required.

The leguminous seeds are particularly rich in lime and in phosphoric acid, that great constituent of the nobler parts of man, the brain and locomotive organs, the apparatus of his mental and corporal powers. As regards the mode of preparing these valuable articles for human food, much has to be learned; but I now exhibit specimens of bread made with various proportions of pea:—Griddle cakes of one-half wheat-flour and one-half pea-flour, one-half wheat-flour and one-half pea-meal, of three-fourths wheaten-flour and one-fourth of pea-flour, of three-fourths wheat-flour and one-fourth pea-meal, of three-fourths wheaten-flour and one-fourth bean-meal; loaves of one-fourth pea-flour and three-fourths wheat-flour, and of one-third bean-meal and two-thirds whole-meal; which I have labelled accordingly, and now submit for your inspection. Pea-soup is an article too universally valued to require notice. Indian meal would be a very fit addition to pea-flour, as its large amount of fat would obviate any astringent property which it sometimes exerts. I may add, that at present these meals may be had at reasonable prices, which, however, would be greatly reduced if the crop were generally adopted. Pea-flour, from which all husk is removed, sells at 3*s.* 6*d.* per stone, pea-meal at 2*s.* 5*d.*, and bean-meal at 1*s.* 10*d.* It is stated that immensively expensive article, "Revalenta," is but Glasgow pea-flour, of about the value of 2*d.* a pound. Beans sold this year in the county of Clare for 8*d.* a stone. Peas enter into the dietaries of the navy and emigrant ships, and are highly prized; and beans form a considerable element of the food of the United States army, and of the labouring population of that country. During the famine, the authorities seem to have recognised their nutritive value: for one vessel alone, the U.S. war-ship "Macedonia," carried over 11,388 lbs. of peas and 19,424 lbs. of beans. A very superior pea is imported from Canada. In Prussia and Germany the pea is felt to be the poor man's comfort; and in Bavaria it is invariably added to the rye-flour in making their bread. I had this summer an opportunity of judging of its value as a general food in these countries. In Scotland, too, it is well known that a mixture of peas and oatmeal forms the staple diet; and the more closely farmers and other employers can be induced to assimilate the food of the Irish to that of the Scotch labourer, the higher they will raise his mental and physical capacities.

The advantages of whole-meal bread over that made with white flour alone are numerous. Chemical analysis shows that one-third of the entire gluten, or nutritive portion of the grain, exists in the bran, and the microscope confirms this fact; and surely it is fitter that this

valuable material should be used by man than bestowed upon our cattle. It has been proved, too, that the large amount of gluten promotes the conversion of the starch into sugar—a necessary change before it can be of the slightest alimentary value. Even the outermost husk is useful, as its finely divided particles stimulate the natural movements of the digestive canal. If this proceed to an objectionable degree, the gluten can be extracted by water, and the bread then made with this. A dog which will sink in forty days if fed solely on white bread will thrive well upon whole-meal bread. The use of the whole-meal would also remove the temptation to adulterate bread with damaged flour rendered white by alum, sulphate of copper, or other injurious agents. If, however, white bread be still preferred, let lime water be substituted for these hurtful salts, as suggested by Liebig, and adopted by the Glasgow bakers with great success. As whole-meal contains three times as much saline matter as fine flour, it is an especially suitable food for children, when the solid framework of the body is being built; and as bran contains six times as much potash as flour, it should not be wasted, as that alkali is the only known preventative of scurvy. We are receding in the art of dietetics in regard to whole-meal bread, for up to some forty years ago it was most generally used in these countries. In France, in 1658, an ordinance of Louis XIV. was issued, which had the effect of compelling the bran to be used with the flour as human food, and in ancient times the process of bolting flour, or separating the bran, was unknown. The gluten which is separated in starch manufactories amounts annually to several thousand pounds; and if this were boiled with water to which a little salt was added, and then dried and ground, a material of the highest nutritive value would be produced.

There are many parts of this country unsuited for the culture of wheat, and in these places rye would form an admirable substitute. It thrives and produces abundant returns in sandy, calcareous soil, even at high elevations; endures greater cold, ripens in a much shorter period of sunshine than wheat, and grows so rapidly that it overreaches all weeds, which are then comparatively harmless to it. It contains equal quantities of nutriment with that grain, and the bread made from it excels wheaten bread in retaining moisture and remaining fresh. Its crumbly character makes it easily digested, and it is said a smaller portion satisfies hunger and supports life than of most other breads, while a smaller proportion of the flour is required to make an equal weight of bread. The only objection which can be urged against it is the trivial one of colour. It forms the staple food of central and northern Europe, and all parts of America where Germans have settled; and it is recorded of the people of Westphalia, who live almost altogether upon it, that they are more free from dyspeptic complaints than almost any other people. Rye contains twice as much lime, and three times as much phosphoric acid, as wheat. M. de Jonnes, a great French statistician, ascertained that the soil of Ireland would produce three times as much rye as that of England, and one and a half times as much rye as wheat.

The leaves of the cabbage plant abound in nitrogen and lime,

materials so deficient in the potato, and have been long recognised as a most valuable addition to that food, in the form of kolcannon. I may mention that in the absence of this plant the leaves of the turnip and other green crops form a most wholesome aliment, which in this country is generally wasted or given to feed cattle, whereas in London they are valued even above the cabbage plant. The removal of the leaves of the turnip would not be injurious to this root, or rather underground succulent stem, at the proper period. It may not be generally known that boiling turnips with the skins on improves the flavour, and renders them so mealy that they may be crushed into a flour, which might be profitably used in making cheap bread. I have now alluded to as many food topics as time will allow; and however humble my ability to discuss them may have appeared, I trust no one will deem the subject unimportant. As an hospital medical officer, the effects of a faulty diet are daily present before me in the patients seeking admission, and I cannot help reflecting on some remedies. The cultivation of maize, buckwheat, quinoa, dhurra, Indian vetch, and other food grains, and the utilization of many now wasted parts of the animals we slaughter, are questions worthy of the attention of economic botanists and agriculturists, and of individuals or societies concerned in the preservation of public health, if such existed in Ireland.

Mr. LOCKE stated that deaths ascribed to starvation were often attributable less to insufficient quantity of food than to insufficiently or unskilfully cooked food. This cause not only originated disease, but also developed diseases latent in the constitution; and many lives would be saved by a carefully prepared nutritious diet during recovery from sickness. This was his experience during the famine of 1846–7, in corroboration of which he read the following communication from the Rev. Wm. Hickey, who regretted that business prevented his attendance that evening. Mr. Hickey was well known as the labourer's friend, under the *nom de plume* of *Martin Doyle*:—"Respecting the labourer's diet, though he may have a sufficiency of the raw material of his food, he is sadly ignorant of the right modes of preparing it. The want of suitable diet for the sick poor is productive of disastrous results; and many deaths are owing to the want of a discretionary power on the part of local Poor Law authorities to assist the distressed patients of dispensaries with nutritious diet. We may assume that the labouring poor will not enter the workhouse, though the alternative be almost starvation; and that a little aid in suitable food and stimulants judiciously administered would facilitate recovery from sickness and debility, under which they are suffered to linger needlessly, and often die. The preservation by such means of the labourer's life would assuredly cost much less than the subsequent maintenance of his family, left probably in hopeless destitution by his premature death. I think that the medical officers of dispensaries ought to have some discretionary power, in cases of urgent poverty, to supply sick or convalescent patients with needful sustenance at the expense of the Unions."

Captain R. J. HENRY said—Having seen a notice in the papers that the gentleman who has just sat down was about to read a Paper on the subject of the "Irish Labourer," this evening, I thought that the present might be a fit opportunity to give the benefit of my own experience to those who may be interested in the same cause; and in doing so I will be as brief as possible. Having taken my home farm into my own hands this year, I felt that something could be done to improve the condition of the labourer. I thought it a pitiable thing to see men, when dinner bell rang, sitting behind a hedge, or crawling into a plantation, to eat their half-cold potatoes, or basin of stirabout, or perhaps a piece of oat cake, brought in their pockets in the morning; and I at once determined to establish a mess, and will now give you the statistics of its working from the commencement up to the present time, i. e. during a period of eight months:—

Dr. THE MESS. CONTRA. Cr.

The Mess is here charged with the total quantities of Provisions supplied from the commencement to the present time.

ARTICLE.	QUANTITY AND PRICE.	£	s.	d.
Oatmeal, .	191 lbs., @ 14s. per cwt. .	1	4	0
Potatoes, .	5 tons 11 cwt. 1 qr. 28 ,, @ 2s. 7d. per cwt. .	17	15	11
Meat, . .	7 ,, 2 ,, 19 ,, @ $3\frac{5}{8}$d. per lb.	12	17	10
Bacon, . .	4 ,, 0 ,, 27 ,, @ $3\frac{1}{2}$d. per lb. nearly.	6	19	10
Dried Fish, .	4 ,, 1 ,, 8 ,, @ 12s. 6d. per cwt.	2	15	2
Eels, . .	2 ,, 2 ,, 14 ,, @ at 2d. per lb. .	2	9	0
Onions, . .	0 ,, 2 ,, 23 ,, @ $1\frac{1}{2}$d. per lb. .	0	9	10
Barley, . .	1 ,, 1 ,, 13 ,, @ $1\frac{1}{2}$d. per lb. .	0	18	10
Butter, . .	0 ,, 0 ,, 10 ,, @ 10d. per lb. .	0	8	4
Flour, . .	1 ,, 1 ,, 12 ,, @ 14s. per cwt. .	0	19	0
Milk, . .	. . . .	3	8	6
Turnips, . .	. . . .	0	0	6
Cabbage, .	. . . .	1	2	4
Bread, . .	2 ,, 3 ,, 1 ,, @ $1\frac{1}{2}$d. per lb. .	2	12	7
		54	1	10

This side shows the number of persons fed during each fortnight since its organization, distinguishing the number of Men and Women, and showing the amount of their contributions each fortnight to the Mess Fund, by deductions from their Wages, at the rate of
Three Pence per day for Men.
Two Pence ,, Women.

DATE.	MEN. DINNERS EACH FORTNIGHT.	WOMEN. DINNERS EACH FORTNIGHT.		£	s.	d.
April 4	116			1	9	0
,, 18	122	36		1	16	7
May 2	112	36		1	14	2
,, 16	97	36		1	9	11
,, 30	77	36		1	6	6
June 13	22	18		0	8	8
,, 27	175	100		3	0	4
July 11	199	149		3	14	7
,, 25	217	152		3	19	10
Aug. 8	217	123		3	14	9
,, 22	222	164		4	1	1
Sept. 5	194	107		3	6	7
,, 19	282	136		4	13	2
Oct. 3	249	100		3	18	11
,, 17	261	127		4	6	5
,, 31	240	126		4	1	0
Nov. 14	232	110		3	16	4
	3034	1556	Total collective numbers of dinners 4590, ...	50	17	10
			Value of Stock in hands, . .	3	4	0
				54	1	10

	MEN.	WOMEN.	Total.
Numbers who dined last fortnight,	19	9	28
Average number of persons dining for the entire period,			$22\frac{1}{2}$

The men are charged 3*d.* each *per diem*, the women and children 2*d.*, which is deducted from their pay at the end of each fortnight. The prices charged in the sheet are the regular market prices in the district, and the people can have any provisions they require for their Sunday dinner at cost price. I endeavour to vary their diet as far as possible; and you will see by the abstract that fresh and salt fish, and fresh and salt meat, are provided for the mess, and the allowance served out each day is as follows, which proves amply sufficient:—Twice a week, broth made from ½ lb. of beef per head, thickened with oatmeal, and with seasoning vegetables; twice do., fresh or salt dried fish, with melted butter; and the other days salt beef or bacon and vegetables. The consumption of potatoes each day is 3½ lbs., and milk, about 1½ pints, per head, the surplus waste of potatoes and other vegetables turning in for farm use. There was some little difficulty at starting, but all was soon got over. Knives, forks, and plates, have taken the places of fingers and tin cans; and the people enjoy a hot and comfortable meal, which, under other circumstances, would be utterly beyond their power or means. Before sitting down, I would wish to point out some advantages which result from this system:—The wife or child, who formerly lost the day in preparing and bringing the midday meal, is now employed at a profit. If a wife have small children, she can now remain at home, and have the necessaries of life at cost price, instead of getting into the hands of those small dealers who are the pests of every country village; and any of the labourers' children, whether able to work or not, can have their dinner at the mess. The labourers have improved in condition and appearance, and are, I am satisfied, able to do a better day's work. I hope soon to be able to supply the people with clothes made at cost price; and, having ventilated the subject among them, I have little fear for its success. Other improvements, I hope, will follow. I have had the statistics of my labourers' mess printed for the information of members who may wish for them, and they now lie on the table, and I shall be happy to answer any questions on the subject as far as I can.

Mr. DENIS H. KELLY, of Castle Kelly, county of Galway, said the subject so ably treated by Dr. Mapother was one of the greatest importance to this country. During the famine years he employed a large number of persons on reproductive works; and he established a mess for his workmen, stopping from their wages one penny per day for a quart of stock soup per man. After a very short experience he found the system worked most satisfactorily. It amply repaid him in the increased strength of the labourers, who did their work well and satisfactorily, and were delighted with the improved diet.

Mr. ROSS, of the Hudson's Bay Company, bore testimony to the great value of jerked beef and pemmican as nutritious articles of diet. The specimen of beef which had been exhibited that evening greatly resembled pemmican; and he thought if it could be prepared without salt, as the pemmican was, it would form a most nutritious and wholesome food for the working classes.

Dr. STEWART said that he had been in charge of several important institutions, and he found that by giving the patients good and nutritive food, a large amount of medicine could be dispensed with. He was of opinion that the best food for man was a mixed food, and that the preponderance of that food ought to be vegetables. If one description of food only were to be used, he thought that a vegetable diet would be preferable to animal diet.

Dr. MORGAN thought, from the analysis of the Monte Video beef, it would prove a most nutritive food. He suggested that an attempt should be made to save meat without salt, the use of which had the effect of extracting some of its nutritive qualities.

Mr. MOWATT at some length advocated a vegetarian diet, and gave his own personal experience of the benefits which resulted from a total abstinence from animal food and intoxicating liquors.

The CHAIRMAN expressed a high sense of the interesting nature of Dr. Mapother's paper, and of the valuable statements of Captain Henry.

Dr. MAPOTHER, in reply, pointed out that the Monte Video beef was so cheap as to justify a large use of it. He had urged that the nutritive qualities of peas and beans were very great, and consequently they formed valuable articles of food. The "Vegetarian Messenger," which advocated the principles of exclusive vegetarianism, also wrote up homœopathy and hydropathy, and wrote down vaccination. The principles of the vegetarians might be dismissed with the single statement—they were an outrage on common sense.

XX.—*Notes on Spectrum Analysis.* By EMERSON J. REYNOLDS, Lecturer on Practical Chemistry, Ledwich School of Medicine and Surgery.

[Read January 18, 1864.]

A CONSIDERABLE time has now elapsed since MM. Bunsen and Kirchhoff announced the results of their important and brilliant investigations on the nature of the light emitted by flames coloured by the presence of volatile compounds of certain metals. The beautiful, delicate, and apparently simple mode of qualitative analysis, by means of spectrum observations, then mapped out, took all by surprise, more particularly since the strongest evidence of the utility of the method was afforded by the rapid discovery of three new metals by its aid.

Since the close of the year 1861, I have employed the method of spectrum analysis in ordinary systematic analytical examinations, and likewise in searching for cæsium, and subsequently for rubidium and thallium, in Irish minerals. I have thus had the opportunity of making many controllable observations, and I now venture to lay my experience in the method of Spectrum Analysis before the Society. I do so more willingly, since this is the first paper connected with the remarkable discoveries of the celebrated Heidelburg Professors which has been presented to the Society; and, however unimportant itself, it may serve to elicit the experiences of others working in the same field.

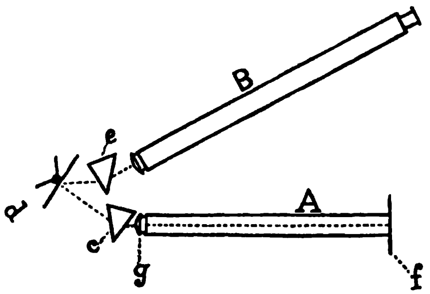
Without noticing the principles on which the Spectrum analytical method is based—as everybody must be well acquainted with them already—I may now commence my "Notes" without further preface.

The first matter to which I should wish to draw attention is the subject of:—

APPARATUS.—The forms of apparatus employed in making spectrum observations are very varied, but the principle remains the same in all. The essential parts of instruments of this kind are:—The slit, formed by two knife edges, which can be made to approach or recede from each other by means of a fine adjusting screw; this slit is placed in the principal focus of a double convex or plano-convex achromatic lens, which renders the bundle of rays transmitted by the slit parallel. On emerging from the collimating lens, the rays pass through a prism, placed at the angle of least deviation, whereby the rays of light, from whatever

source they may proceed, are refracted, and at the same time decomposed; the Spectrum so obtained is then examined by means of an astronomical telescope, arranged so as to be capable of circular motion round the prism. Such is the "Spectroscope" in its simplest form; but instruments are now constructed with as many as nine prisms, which have performed the same office for several of the lines in the solar spectrum that Herschell's or Lord Rosse's telescopes have done for some of the nebulæ. For all general analytical purposes the best instrument is that in which only one or two prisms are used, as a larger number obstruct too great an amount of light, and, moreover, the extent of spectrum to be observed is inconveniently large. This is particularly the case with hollow prisms filled with bisulphate of carbon, as the dispersive power of that liquid is so much greater than glass. Spectroscopes, as hitherto constructed, generally have the second or observing telescope moveable in a horizontal plane; and in the case of a double disulphide of carbon prism instrument, it (the telescope) makes nearly a right angle with the first tube carrying the slit and collimating lens. Hoffman, the celebrated optician, introduced some time ago a very ingenious form of apparatus, which does away with the angular motion of the observing telescope, and enables the experimenter, by direct vision, to examine the spectrum of any plane to which he may point the instrument. Mr. Yeates, of this city, has recently introduced an improved form of the direct-vision spectroscope, which is one of the most perfect instruments of its kind which I have seen.

The spectroscope which I use I have had constructed in a manner differing somewhat from that usually adopted. Its arrangements may be understood by reference to the accompanying woodcut:—



A, is the first telescope, about 10 inches in length, carrying the slit, *f*, and the collimating lens, *g*; the bundle of rays transmitted by *f*, after being rendered parallel by *g*, pass through the prism *c*, and thence to the mirror *d*, from which they are reflected, and made to traverse the second prism, *e*. The spectrum thus obtained can be then examined

by the observing telescope, *B*. Each of the disulphide of carbon prisms has a refracting angle of 60°, and the telescope a magnifying power of about 8°. The advantage of this instrument I find to consist in the facility with which the observer can regulate the slit, and introduce the test specimen into the gas flame, without any assistance; and while at the eye-piece of the telescope, at the same time, this advantage is gained with a minimum number of prisms, and without any complication of apparatus.

THE DIFFERENT MODES OF OBTAINING SPECTRA.—The methods by which the spectra of the metals of alkalies and alkaline earths can be produced are too well known to need much description; but there are some points to which I shall draw attention. The flame of Bunsen's burner is the source of heat generally employed in spectrum observations; but the simple hydrogen flame I have always found much superior to it for general use, both on account of its more intense action on the bodies submitted to its influence, and the increased brilliancy of the spectra observed. I now always keep an apparatus, constructed somewhat on the principle of a Döbereiner lamp, with my spectroscope, so that at a moment's notice I can have a steady jet of hydrogen without any trouble. In examining mixtures of salts which become basic when heated strongly—such as chloride of calcium—I have found it useful to pass the hydrogen over pure and concentrated hydrochloric acid, the small quantity of the latter taken up being sufficient to bring about the volatilization of the basic compound. By far the best jet which can be used for the hydrogen flame is a portion of the shank of a common tobacco pipe; all other jets which I have used impart colour to the flame at intervals, but the common clay burner rarely if ever does. The zinc used in evolving the hydrogen need not be perfectly pure, as the presence of a very small quantity of arsenic does not interfere with the spectrum reactions of the salts of any of the metals. Whether the flame of a Bunsen burner or simple hydrogen jet is used as the source of heat, it is only necessary to introduce the test specimen into the flame on the platinum wire, and to examine the nature of light emitted by means of the spectroscope, in order to obtain the spectrum produced by the salt or saline mixture under examination.

The spark obtained between the secondary wires of a powerful induction coil is far superior to all other methods for obtaining brilliant and intense spectra, not alone of the alkalies and alkaline earths, but of most of the heavy metals and of the gases. The appearance of the spectrum afforded by the passage of the spark between electrodes of copper, of zinc, or of iron, is brilliant in the extreme—in fact, spectrum observations of this kind afford the observer the opportunity of examining some of the most beautiful phenomena which the whole range of the natural sciences can present. The application of the induction spark to general analytical work, however desirable it may be, is practically inconvenient, in consequence of the necessity for using two of Groves' or Collier's cells, in order to keep the Rhumkorff coil in action. Apart

from the consideration of the trouble involved, there is no mode more satisfactory in examining any solution for the alkalies or alkaline earths than to moisten the platinum terminals of the secondary current with the liquid to be tested, and observe the spectrum of the spark passed between them; the constituents of the mixture can be thus ascertained with the greatest facility. Before concluding this section, I must observe that the ordinary spark of the induction coil does not possess sufficient "body" for spectrum observations; it is therefore always necessary to place a weight on the hammer for making and breaking contact, in order to increase the resistance; each of the secondary wires should likewise be made to touch one coating of a Leyden jar. By this arrangement a very broad and brilliant spark is obtained, the spectrum of which can be observed with perfect ease.

NOMENCLATURE OF THE LINES OF THE SPECTRUM.—In accurate observations on metallic or other spectra it is always necessary to measure the relative distances between the different lines as seen through a particular instrument. This may be accomplished either by reflecting an illuminated scale, so as to make it appear superimposed on the spectrum, or by the estimation of the angular distance traversed by the observing telescope, in order to bring two lines into the same position in the field of view. It is the graduation of the scale used to which I would now draw attention. It has been the general practice to take one line, such as that of sodium, as a starting point, and to express the distances on either side of it in millimetres; or, as I have occasionally seen, the commencement of the scale is selected by chance, and its mode of division is purely arbitrary. The means which I have long used for obtaining a distinct measure for the whole spectrum consists in taking two well-defined lines, and dividing the distance between them into 100 parts. It is obvious that the scale can be continued both above and below the fixed points. The lines which I use are the Liα of the lithium, and the Srδ of the strontium spectrum. These were selected in consequence of their brilliancy and sharpness of outline, and, moreover, because the distance between them is of sufficient extent in ordinary instruments to admit of accurate graduation. Liα is at the zero of my scale, and Srδ corresponds with the hundredth division. All lines occurring below the zero can be represented with the minus sign affixed to the numbers indicating their positions; thus approximating the mode of division to that of the centigrade thermometer. I should here observe that the measurements on this, as on any scale, vary with the nature and dispersive power of the prisms. By adopting the method just described, a simple nomenclature might be given to the lines, which would at least have the advantage of being more systematic than that hitherto used.

THE APPLICATION OF SPECTRUM ANALYSIS TO THE EXAMINATION OF MINERALS.—Under this head I propose to discuss some points which have arisen respecting the real aid to be derived from the method of spectrum analysis as it now stands in the examination of minerals.

It is well known that the spectrum afforded by a solid in a state of ignition is continuous; but that of a luminous, and consequently ignited gas, consists of certain maxima of light separated by intervals of actual or comparative darkness. Since almost every elementary body furnishes bright bands in its spectrum peculiar to itself, it is obvious that, in order to detect the presence of any particular element, we must obtain it, or its compound, in the state of a luminous vapour. It is rarely that we meet with uncombined elements in nature, and even when we do, they are usually of such a kind as require extremely high temperatures before they can be converted into vapour; therefore it is generally a compound of the metal sufficiently volatile at a moderate degree of heat which is used. In the mineral kingdom, however, metals usually occur in combination with more or less fixed acids, forming salts, which are generally non-volatile, and not easily decomposable. As instances of these we may take sulphate of barium in heavy spar, and the silicates, such as orthoclase, which are unacted on by acids. It is an easy matter enough to recognise the presence of any particular body by the appearance of its spectrum; but the difficulty which I have always found is to easily obtain a spectrum under all conditions of metallic combination. Bunsen and Kirchoff recommend the treatment of silicates first with hydrofluoric acid or fluoride of ammonium, in a platinum dish, then treating with sulphuric acid, evaporating to dryness, and dissolving out the salts, again evaporating, and then examining the residue in the spectrum apparatus. This decomposition of the mineral under examination is comparatively tedious and troublesome, and is worth trying to avoid.

After many trials of different methods which suggested themselves, I think I have found one by means of which the decomposition of most minerals may be effected at high temperatures, and the spectra of the constituent metals observed with some degree of certainty.

It is a well-known fact that the spectrum observed during the decrepitation of *any* salt is much more brilliant and intense than that produced during the simple volatilization of the particular compound. We may assume without much hesitation, that the water is the prime agent in producing this result. The decrepitation spectrum, if I may so call it, of any chloride, and that afforded by the *chlorate* of the same metal, bear many points of resemblance. It would seem, therefore, that the presence of free oxygen materially affects the brilliancy of the spectrum. With a chlorate of a metal oxygen is given off on heating; but with a decrepitating salt the case is different—the water, suddenly set free in the flame, almost instantly attains a very high temperature; its constituents then exist in the condition termed by Hoffman and by Deville "disassociation," in which state the oxygen of the water is to all intents and purposes free.* I have based the mode which I now adopt in treat-

* The steam is best generated in a small flask of about 6 ounces' capacity, into the cork of which should fit the ordinary jet apparatus and a small porcelain safety-valve.

ing minerals on these observations, and likewise on the well-known fact that the presence of water at high temperatures effects the decomposition of a large number of saline combinations, otherwise perfectly unalterable by heat alone.

The apparatus which I use is very simple, consisting of an ordinary Herapath blow-pipe jet, through the air tube of which a fine current of steam is sent into the interior of the flame. The steam jet must not be sufficiently powerful to blow the test specimen off the platinum wire when the latter is held in the flame. When the jet has been properly adjusted, the flame should be moderately long, and of a pale greenish-blue colour. These conditions are easily realized by the arrangement of the inner tube delivering the steam. Most of the minerals which I have examined are decomposed with facility when subjected to the action of the blast flame.

When it is only necessary to ascertain the presence or absence of a member of the alkali group in a silicate, I have occasionally taken advantage of the plan proposed by Cartmell for another purpose. It consists simply in heating a mixture of the powdered mineral and pure gypsum on a platinum wire in the flame of a Bunsen burner. The silicate is decomposed, silicate of calcium and sulphate of the alkali or alkalies being formed, which latter volatilize at the temperature of the gas flame.

Having described the means by which minerals can be made to afford the spectrum reactions of some of the metals contained in them, we may now inquire how much reliance may be placed on spectrum observations made on mixtures of various salts of the alkalies and alkaline earths. Before discussing the question, I may quote the words of Bunsen:—"A mixture of the chlorides of potassium, sodium, lithium, barium, strontium, and calcium, containing at most $\frac{1}{10000}$dth part of a grain of each of these salts, was brought into the flame, and the spectra produced observed. At first the bright yellow sodium line $Na\alpha$ appeared, with a background formed by a nearly continuous pale spectrum. As soon as this line began to fade, the exactly defined bright red line of lithium, $Li\alpha$, was seen; and still further removed from the sodium line the faint red potassium line, $K\alpha$, was noticed; whilst the two barium lines, with their peculiar form, became visible in the proper position. As the potassium, sodium, lithium, and barium salts volatilized, their spectra became fainter and fainter, until, after a lapse of a few minutes, the lines $Ca\alpha$, $Ca\beta$, $Si\alpha$, $Si\beta$, $Si\gamma$, and $Si\delta$, became gradually invisible, and, like a dissolving view, at last attained their characteristic distinctness, colouring, and position, and then, after some time, became pale, and disappeared entirely." Kirchhoff likewise appears to think that the spectrum analytical method overcomes all difficulties regarding the examination of saline mixtures; and he refers to the substitution of the prism for the coloured glasses and liquids used by Cartmell, and indicates the value of the new method in accomplishing with greater precision the same object as that contemplated by Cartmell. He also observes that "a mixture of salts of different metals gives a spectrum similar to that which

would be produced by a superposition of the several spectra of the individual metals."

Long continued observation of coloured flames has convinced me that these statements of MM. Bunsen and Kirchhoff are not wholly correct; in fact, it can be easily shown that the spectrum afforded by a mixture of salts depends to a great extent on the relative proportions of the constituents of the mixture. The experiment of Bunsen above noticed, and which he so graphically describes, affords the most convincing proof that the metallic spectra interfere with each other, and that, moreover, to a very material extent. If we introduce into the flame of a Bunsen burner a chloride of any metal of the alkalies or alkaline earths, it almost immediately commences to volatilize. The alkaline chlorides, being more volatile than those of the alkaline earths, are first completely dissipated in vapour. Chloride of lithium is but little less volatile than chloride of sodium. In Bunsen's experiment the quantities of the various chlorides composing the mixture were about equal; therefore the order in which the several spectra appeared seemed to indicate the relative degrees of volatility of the different chlorides. Now, the sodium spectrum appeared first, and as it faded the lithium spectrum became visible; but since the volatility of the lithium salt is but a little below that of chloride of sodium, some of the former must have volatilized with the first portion of sodium vapour, though it escaped detection; it was only when the sodium light diminished in intensity that the lithium spectrum made its appearance, together with the spectra of potassium and barium. From my own experiments on this subject, I feel but little hesitation in saying that these three spectra were masked at first by the presence of sodium. Such being the case, the conclusion is inevitable, that if a sufficiently large amount of sodium were present in proportion to the chlorides of the other metals, no spectrum but that of sodium would be obtained, and we should therefore fail to detect lithium or potassium, though they were actually present. So far as my experiments have gone, sodium and barium compounds interfere most with the spectra of other metals, the presence of barium materially enhancing the absorptive effect of a small proportion of sodium. I have not yet succeeded in finding any good and simple remedy for the somewhat serious defect just noticed. In all cases where the spectrum obtained from the hydrogen flame or Bunsen's burner is at all doubtful, I have recourse to the induction spark, which clears away the difficulty.

ON THE PRESENCE OF THALLIUM IN IRISH MINERALS.—Though I have examined a very large number of Irish metallic ores for thallium, I have as yet succeeded in detecting it in but very few, and in none of the specimens did it amount to more than a mere trace. The only ore in which I could detect it by ordinary chemical means, and even then when employing large quantities of the mineral, was the copper pyrites from the Knockmahon mines, Bonmahon, county of Waterford. I was able to obtain about four pounds' weight of the ore, and from this quan-

tity I could only prepare a minute specimen of sulphide of thallium, which I exhibited at one of the meetings of the Geological Society last session.

In conclusion, I may observe that cæsium and rubidium have not yet been detected in Irish minerals; but I hope in the course of the ensuing summer to have the opportunity of examining many more minerals than I have hitherto done.

XXI.—*The Supply of Fuel in Ireland: an Inquiry into the Character and Extent of the Irish Coal-Fields, Peat, Marshes, &c.* By H. O'HARA, C. E.

[Read January 18th, and March 21st, 1864.]

THE inhabitants of most countries derive their supply of fuel from their forests and their woods. It is only within a very recent period that pit or "sea coal" has come into general use; and the people who first used it were the inhabitants of the west of Europe, and of the northern states of America. Ireland does not contain a single forest; and the few woods that are scattered through the country are so circumscribed in extent, that if they were cut down for fuel, and their produce exclusively consumed, they would not, at the present rate of consumption, afford the population a seven years' supply. This scarcity of timber in Ireland is a great disadvantage, which should be overcome by increasing the number of plantations in uncultivated districts. The aspect which the surface of the country presents at present, with regard to vegetation, is extremely different from its aspect a few centuries ago. We have abundant proofs that formerly Ireland was one vast forest. In times of warfare broad tracts were cleared to facilitate military operations, and extensive woods were consumed by fire. Immense quantities of timber were likewise consumed by the numerous forges and iron furnaces which at various periods were in a state of great activity. The remains of these ancient bloomaries, which are met with in the counties of Antrim, Leitrim, Roscommon, Sligo, Tyrone, Kilkenny, Carlow, Tipperary, Limerick, Kerry, and Cork, prove that the smelting of iron was very general in Ireland previous to the complete exhaustion of the supply of wood. The destruction of the forests must have caused a considerable change in the climate, and a still greater change in the soil. Indeed, the most remarkable effect has been the conversion of one-seventh of the country into a swamp. This has occurred through the greater exposure of the surface of the land to the moist winds of the Atlantic, which are highly favourable to the growth of a species of moss known as the *Sphagnum palustre*. This moss thrives only in exposed situations; and so favourable is the present condition of Ireland to its propagation, that if the existing arable

and pasture lands which have a south-western exposure were abandoned to nature, most of them would be covered by peat moss to a height of several inches in the course of a century.

The morasses which have been formed by the growth of this and other mosses, as well as by numerous species of reeds and rushes, are not confined to any particular district of the country, but are scattered over the entire island. They are chiefly valuable as sources of fuel; but they also contain the trunks and roots of numberless elm, fir, oak, yew, ash, and willow trees, many of which are in a sufficient state of preservation to be manufactured into articles of household furniture. Generally speaking, the peat moss, as cut by the peasant and burnt in his cabin, is not so good a fuel as wood. It contains a large quantity of water, which can only be effectually removed by the action of a dry current of air, as the fibrous structure of the peat causes it to retain moisture so obstinately that only the brisk heat of a kiln will completely drive it off. However, large quantities of turf are sold in the country towns and cities, which, having had the advantage of being stored during the summer months, are comparatively dry, and make a cheerful fire. Although nearly all the bogs are alike in their general character, yet there are differences between them, and much difference between the peat cut in different parts of the same bog. Near the surface, and frequently for a depth of 4 ft. or 5 ft., the organization of the several mosses is perfectly discernible; and from thence downwards to a variable depth, the structure of the plant may be traced through various stages of decay, until at the bottom of the morass all traces of it are lost in the complete decomposition which has ensued. The dense peat which forms the lower stratum of a bog makes the best fuel. Throughout the Kildare and King's County marshes the black or bottom peat has a somewhat earthy appearance; but nevertheless it burns well, and large quantities of it are conveyed by canal to Dublin for consumption. In Fermanagh, Donegal, and many of the northern and western counties, the dense peat of the numerous bogs is extremely rich in inflammable matters. It cuts like cheese, is easily dried, and burns almost like bituminous coal. In this peat considerable numbers of the trunks and roots of fir trees are found; and the resin and turpentine which they contain impart such combustible properties to the peat in contact with them, that it burns rapidly with a bright flame. The country people dry the roots of the fir, split the fibres longitudinally, and burn the splinters as candles. The oak trees found in the bogs, being in a tolerable state of preservation, are considered too valuable to be used as fire-wood; and as they are usually black at the outer rings of growth, owing to the tannic acid which the bark contains being acted upon by the iron held in solution by the bog waters, the wood is much prized for ornamental carvings. Most of the morasses are situated in the middle of the country; and if two lines were drawn,—one from Donegal to Bray, and another from Galway to Arklow,—they would include between them by far the greater proportion. Their situation is in no way peculiar, being found extend-

ing alike over the plains and mountain summits, and resting on marl, alluvium, gravel, and even upon the bare rock. The mosses thrive better, and consequently grow with greater rapidity, on low than high lands; and owing to this fact, the bogs which are situated upon mountain tops and slopes rarely exceed six feet in depth, whereas the bogs of the lowland districts vary from a mere superficial covering to a depth of forty or fifty feet.

The peat which is obtained from a mountain bog is usually much denser, blacker, and more impure than the peat moss of the plains. This impurity is often owing to the disintegrated portion of the rock being disseminated throughout the mass, which circumstance lessens its value as a fuel; and the greater density and blackness are owing to the slower and more stunted growth of the moss, and to atmospheric influences. The area of the bogs which are spread over Ireland amounts to 2,830,000 acres. Of this quantity 1,255,000 acres rest upon the mountainous and hilly districts near the coast; and the remaining 1,576,000 acres extend across the great limestone plain, and contain an almost inexhaustible supply of fuel. But as the turf is at present prepared for use by the peasantry, its heating power is not sufficiently intense to be employed with advantage under steam-boilers. It is bulky, and contains about 20 per cent. of moisture, sometimes more and sometimes less, according to the season in which it has been cut.

One of the greatest obstacles to the more general introduction and consumption of peat as a fuel, lies in the fact that the bogs are suffered to remain in so swampy a condition that the turf cannot be properly prepared for use without a considerable expenditure of time and labour, or the aid of machinery, to squeeze out the water. In a country where there is such competition for the possession of land, it is difficult to account for the present neglected state of nearly 3,000,000 acres. Much has been spoken, written, and proposed in connexion with the subject of the reclamation of these marshes, but nothing really practical or scientific has yet been attempted on a large scale. The mode of turf-cutting adopted by the peasantry is the rudest possible. No effort is made to drain the marsh, but the fuel is cut at the margin in shallow detached pits resembling quarries, and the interior portions of the bog remain unwrought, and in the condition of a quagmire. If a few deep trenches were cut transversely through the entire length of a bog, the whole of the superfluous water could readily be conveyed to a lower level, and got rid of. By this means the surface could be reclaimed at very little expense, and cultivated, and the peat in every part of the marsh would become accessible, and considerably improved in density and dryness. The climate of England is almost as favourable to the growth of aquatic mosses as that of Ireland, and the peat marshes are almost identical; yet vast tracts have been brought under tillage at an expense of millions of money, which has long since been amply repaid by direct returns, without taking into account the increased salubrity of the districts so improved. To render our peat more generally useful as fuel, a very important improvement might be

effected in the size of the turf sods, as their present shape and dimensions are those of a brick—a form which is most unsuitable to proper combustion in fire-grates and furnaces. If the turf were cut in three-inch cubes, it could be used with greater convenience and economy. It is not the custom to sell turf by weight in this country, but it is generally understood that in the immediate vicinity of the turbaries of the western counties, the measures which are employed in the sale of the commodity reduced to weight are equivalent to a rate of four shillings per ton. In the central and southern counties, the present rate is about *5s. 3d.* per ton; and should the emigration continue, it is probable that it will rise to six or seven shillings per ton. The price of turf is almost exclusively made up of wages for labour and the cost of carriage, and the supply of labourers in any given district regulates the expense of the fuel. Thus, in 1825 the average cost of turf in the vicinity of most of the turbaries was only *2s. 8d.* per ton, and in 1844 it was *3s. 9d.*

Peat, when properly prepared, is, in Ireland, a cheap, plentiful, and excellent fuel. The vast mass of the poorer classes in the interior of the country are mainly dependent upon it, and in many parts all classes are obliged to rely upon it exclusively. There are many inland districts in which bogs are scarce, and a turbary is regarded as the most valuable property in the neighbourhood. In such localities the proprietors have frequently allowed the moss to again vegetate after most of the peat had been removed, in order that the supply might not be completely exhausted. But there are very few localities so situated. The bogs are so distributed over the country, the coal-fields so dispersed, the seaport towns so numerous around the coast, and the inland navigation and railway systems so arranged, that almost every spot in the island is within reach of an abundant supply of fuel.

Although the area under bog has been estimated at 2,830,000 acres, yet we may regard the extent as comprising about 2,000,000 of acres, as many of the marshes have been recently reclaimed, and others completely exhausted. If we allow an average depth of 3 yards, and estimate a cubic yard of dry peat to weigh 550 pounds, we shall find that the quantity of available fuel from this source amounts to 6,338,666,666 tons. On pursuing the calculation further, and taking the economic value of turf compared with that of coal, as 9 to 54, the total amount of peat fuel in Ireland is equivalent in power to above 470,000,000 tons of coal; and estimating coal at twelve shillings per ton, we find the money value of all the peat in Ireland to be £280,000,000 sterling. Large as this sum is, it might be greatly increased if the same means were adopted in Ireland to utilize peat that are successfully prosecuted in other countries. In Bavaria, France, and even in North America, where coal and wood are in enormous abundance, the bogs are converted into sources of wealth, and are not suffered to remain the unproductive and unsightly swamps which they are with us. The marshes are partly drained; and the effect of the removal of the water from the peat is to convert it into an excellent fuel,

which is denser than oak wood, and bears about the same price in the market. It is preferred in those countries to any other kind of fuel, as its smoke has not the irritating effect upon the eyes, nor does it obstruct respiration, like the smoke of wood. Neither has it the drying effect upon the air of an apartment, nor the unpleasant sulphurous odour common to coal. At Rhode Island the inhabitants spend much care on its preparation, and burn it in grates specially adapted to its combustion, and the result is a considerable amount of domestic comfort. The calorific power of our ordinary dry turf is about one-third that of good English coal. Turf, being spongy, retains the water, and this water often amounts to one-half of its weight, but generally the quantity varies from a third to a fourth, according to density. One pound weight of good dry turf will evaporate 6 lbs. of water. But it must be remembered that there are several qualities of turf, even in the same bog. Near the surface, peat is light-coloured and spongy, owing to the fact that the decomposition of the plants has not been fully effected; deeper it is brown; and at the bottom it is so dense that it approaches nearly to coal, both in appearance and chemical composition.

The ash obtained from peat in these three positions varies also considerably, and the following may be regarded as representing the average percentage residue :—

Surface, ...	1·50
Middle, ...	8·25
Bottom, ...	19·00

Turf yields a considerable bulk of volatile and inflammable gases, which distribute the heat evolved during combustion through a greater space than most other fuels, and hence it may be found useful in many operations requiring a diffused heat. In this characteristic it differs remarkably from anthracite, which yields an intense and concentrated heat. The want of density, which is a characteristic of turf as a fuel, is probably the chief objection to its use in large manufacturing operations; but this may be so readily overcome by subjecting it to pressure, before use, that we may yet hope to see it extensively employed as compressed peat.

On the southern shores of Lough Neagh we have an extensive deposit of fossil wood, which is known by the name of *lignite*. This substance is intermediate in its composition between coal and wood, and, as it generally retains its woody structure, and is of a deep brown colour, it is often called wood coal. The deposit in which the lignite beds are enclosed covers an area of 60 square miles, and contains three large layers, which vary from 15 to 25 feet in thickness, besides several smaller ones. The thickness of the same beds varies in different parts of the basin, and borings that have been made in several places within the area prove that the lignite lies at variable depths. At Sandy Bay, in Antrim, several pits were sunk, and considerable quantities raised for local consumption.

When lignite is ignited, it burns well, gives off smoke, and leaves a dense charcoal as residue. This fuel is of a deep brown colour, presenting the structure of wood. It is far inferior to coal, as its heat is less intense and more diffused. Indeed, there is no fuel which is possessed of so many advantages as coal, and our main reliance must be upon it for generating the heat essential in most manufacturing operations.

There are so many varieties of coal, that it is extremely difficult to classify them. Almost every separate coal-field will contain a fuel differing in a marked manner from the character of the coal occupying another. Even in the same field there will often be found some difference between the coal raised from separate pits; and more remarkable still is the fact, that the several beds through which the shaft of a mine is sunk may yield coal of several qualities. Perhaps the best classification would be into bituminous, semi-bituminous, and non-bituminous. The bituminous varieties include cannel coal and caking coal. The semi-bituminous are called steam coals, and are largely employed under steam boilers, and for most smelting operations.

The non-bituminous coals are known as anthracites, and are extensively used in the manufacture of iron, lime-burning, and hop and malt drying. The anthracites are heavier than common coals, and contain from 80 to upwards of 95 per cent. of carbon.

Coal has been found in seventeen counties of Ireland, and in each of the four provinces. The names of the counties are:—Antrim, Fermanagh, Leitrim, Queen's County, Donegal, Monaghan, Roscommon, Kilkenny, Tyrone, Cavan, Westmeath, Carlow, Tipperary, Clare, Limerick, Kerry, and Cork.

Sir Richard Griffith, who was the first to publish a general description of the Irish coal-fields, grouped the areas occupied by the coal deposits into four great fields, which he named after the four provinces into which the country is divided. The coal found in Leinster and Munster burns without flame, and receives the names of anthracite, culm, and stone coal; that found in Ulster and Connaught burns, for the greater part, with flame, and is consequently known as blazing coal. The Leinster coal-field occupies portions of the Queen's County, and the counties of Carlow, Kilkenny, and Tipperary, but it is divided into three distinct and detached portions by the limestone rock upon which the coal beds rest. The Munster coal district is the most extensive in Ireland. It occupies large portions of the counties of Clare, Limerick, Kerry, and Cork. The Connaught coal-field occupies portions of the counties of Roscommon, Leitrim, and Sligo. The Ulster coal district is of small extent. It occupies portions of Antrim, Monaghan, and Tyrone. There is also a small patch of coal in the county of Cavan, which is remarkable from the fact that it occurs in rocks of the Silurian age, and not in the true coal measures, or Carboniferous group common to the rest of Ireland. The sum of the areas of all these coal-fields, or, in other words, the extent of country beneath which coal spreads, is 1,881,600 acres.

The coal district of Antrim is situated on the north coast of the county, and extends for four miles along the shore between Murlough Bay and Ballycastle. Its average breadth, southwards, is about one mile and a half. The upper portions of the strata composing the Antrim coal formation are visible in the precipitous cliffs of the coast, and exhibit a thickness of basalt, sandstone, shales, and coal, which amounts in some places to upwards of 350 feet. Inclosed in the strata, at Murlough Bay, there are six beds of coal, four of which are highly bituminous; and the other two, which are nearly in contact with a trap dyke, are carbonaceous. The strata are very much deranged by the numerous dykes of basalt which traverse the district; and in such places as the coal has been cut through by one of these volcanic veins, the coal is charred, and otherwise altered for a short distance, which is usually in proportion to the size of the dyke.

The Ballycastle collieries are considered the most ancient workings in the British Islands. Their area is about 120 acres; and although the greater part of the coal has been extracted long since, considerable quantities of the ironstone are raised at present, and exported to Scotland. A considerable number of pits were sunk here in the early part of the last century, and the works were vigorously carried on, as they were stimulated and sustained by large grants of money from the Irish Parliament. About that period, as the workmen were driving some new galleries, they broke into several extensive works, in which were found antique implements, and other remains, which led to the conclusion that these mines must have been excavated a great many centuries ago by a people who were as expert at their calling as the coal miners of the present day. The Murlough Bay collieries have been worked to a very limited extent, and there are several seams throughout the Antrim district that have never been opened.

The coal district of Tyrone is situated a few miles to the west of Lough Neagh. The coal area of the district is very small, but the beds are of the most valuable kind. The coal is highly bituminous, and has been largely wrought. It resembles Whitehaven coal in appearance, burns rapidly, and gives out a strong heat. Several collieries have been for a long time established at Drumglass, Coal Island, and Annahone. Four of them have ceased working, and the only colliery at present in operation in the district is that situated at Drumglass. The "large" coal raised at this colliery is consumed to a considerable extent in the neighbourhood, and supplies the mills, distilleries, and dwelling-houses with an excellent fuel at 13*s*. per ton. The "small" coal is disposed of at 7*s*. per ton, and is employed for burning lime and bricks. The superior quality and thickness of the coal seams of this district, coupled with the fact that they occur in a neighbourhood which is thickly inhabited by an industrious population, give them much interest. The district is separated into two divisions, called respectively the Coal Island and the Annahone districts. The Coal Island district, which is the larger of the two, is of an oval form, about six miles long by two broad, and contains an area of about 7000 acres. The Annahone district is

not more than a mile long, and half a mile broad, having a superficial area of about 300 acres, but supposed to be much greater, and to extend for a considerable distance beneath the sandstone rocks which lie to the south-east. In a part of the district, called Annagher, there are five workable beds of coal, some of which have been partly wrought at various times. The thickness of each seam is as follows:—

	Ft.	In.
V. Coal, containing a seam of cannel coal,	6	0
IV. Coal,	8	0
III. Coal (Brackaveel coal),	5	0
II. Coal,	4	6
I. Coal, slaty and impure,	2	2

Making a total thickness of nearly 21 feet.

There is a small detached coal basin in the county of Monaghan, near Emyvale, which contains a few narrow seams of impure coal, which would hardly repay the cost of extraction. These, and the locality in which anthracite is found in the Silurian rocks of Cavan, are the whole of the coal-fields which exist in the Ulster district. In the county of Antrim there are two collieries, those of Ballycastle and Murlough Bay, neither of which is at present working. In the county of Tyrone there are three, namely, Annahone, Coal Island, and Drumglass, only one of which is at present in operation. The colliery of Kill, in the county of Cavan, is not at present working.

The province of Connaught contains the extensive district of Arigna, which is situated to the west of Lough Allen. This district contains three beds of bituminous coals. One of the two beds, which extend through Kilronan Mountain, is at present wrought on the northern slope, and the coal is sold in the neighbouring towns for 10*s*. a ton, and the culm sells at 8*s*. The bed is 18 inches thick; but the lower bed, which is separated from it by about 40 feet in depth of sandstone, is only 8 inches thick, and yields culm of very inferior quality. The coal extracted from the upper bed is of excellent quality, and, including the culm, is raised to the pit mouth at a cost of 5*s*. 6*d*. per ton. The various coal deposits which have received the appellation of the Connaught coal-field form a group around Lough Allen, which forms a basin in the centre of the district. The most productive deposits are two which are situated in the counties of Leitrim and Roscommon, within little more than a mile of each other. The coal of the entire district is bituminous, and of good quality. The total area of the Carboniferous rocks which surround Lough Allen on all sides, and on which the coal deposits rest, is about 320 square miles. Throughout this area there are numerous bands of ironstone of excellent quality, but the ore is now only valuable when in the immediate neighbourhood of a bed of coal. Before coal was applied to the smelting of iron, wood was the only fuel employed, and several extensive forests which flourished around the banks of Lough Allen were entirely consumed to supply the furnaces which were formerly in a state of great activity in the district. The Arigna coal-field is the largest in the Connaught

group, and has hitherto been the most productive. Its area is 5760 acres, and it contains one bed of coal and one bed of culm. The Altagowlan coal-field, which is situated about one mile to the north of the Arigna deposit, has an area of 2500 acres, and contains two seams of good coal, one of which is 1 foot 9 inches, and the other 2 feet thick. The thickness of these seams is not constant over the whole area. In some places the beds become gradually thinner, and in other places their thickness increases. Towards the county of Sligo it is well known that the "two-foot" seam increases considerably. The Meneask colliery is situated on the summit of Lugnaquilla Mountain, six miles north of Lough Allen, and on a field of 840 acres of slaty coal, which is 10 feet thick, including an 8-inch seam of good coal. One mile to the east of the lake there is a large oval tract of 4480 acres of coal, which covers the summit of Bencroi Mountain. There are also two or three small detached coal fields within the district, whose areas, added to the areas of the others in the same district, make a total of 17,550 acres, representing a weight of over 18,000,000 tons of bituminous coal. As in all other coal-fields, the strata of this district are dislocated by several faults; but, on the whole, the seams are tolerably regular, and their dip seldom inclines at a greater angle than 10° from the horizon.

The most important division of the Leinster coal district measures 21 miles north and south, and 14 miles east and west. The coal strata are conformable to the limestone rock upon which they rest, and which surrounds this and the other divisions of the district. The general stratification is, however, extremely irregular, and the surface of the ground, in the interior of the coal country, uneven. This division contains an area of over 230 square miles. Sir Richard Griffith, who made a careful survey of the district, considers that it contains eight beds of coal, all of which are workable. The following list gives the local name of each seam, and its thickness:—

		Ft.	In.
VIII.	The upper 3-foot coal,	3	0
VII.	The double seam,	2	6
VI.	The lower 3-foot coal,	3	3
V.	The Drummagh foot coal,	1	0
IV.	The 4-foot coal,	4	0
III.	The upper slate coal,	3	0
II.	The lower slate coal,	3	0
I.	The Rossmore foot coal,	0	10

The limestone, which underlies the coal measures, rests immediately upon the granite, and the strata are consequently much contorted, a circumstance which renders the search for coal a matter of considerable difficulty. Many of the bands of ironstone, associated with the coal seams, are very rich, and in several places there are the remains of ancient excavations and forges, which attest the former industrial activity which existed in the locality. The manner in which the rocks are bent and dislocated in this district, renders the working of the coal seams troublesome and expensive. Notwithstanding this

disadvantage, the extraction of coal and culm has been carried on during a great number of years, with varying degrees of success.

Over the entire of the Leinster coal area an incredible number of shafts has been sunk, and an examination of the district proves that no means have been left untried to turn the coal beds lying beneath the surface to profitable account. The upper 3-foot coal occupies but a small area, as it only occurs between two slips in the strata of Coolbawn Hill. It is almost worked out. The double seam, as its name implies, consists of two beds of coal, separated by a bed of fireclay, 18 inches thick; each coal bed is about a foot in thickness, and the superficial extent of both is small. The lower 3-foot coal furnishes the valuable fuel known as the "Kilkenny anthracite." Its quality is far superior to the anthracites of Scotland and South Wales, and it is remarkable for its hardness, durability in the furnace, and intense heat when ignited. Its extent is not very great, as it only occurs in detached patches throughout the county of Kilkenny and the Queen's County. Several important collieries have at various times been established on this valuable seam, the most important of which was commenced 150 years ago by Sir Christopher Wandesforde, at Castlecomer, over an area of nearly 3000 acres. This colliery, and most of the others situated upon the seam, are almost exhausted; for such has been the activity with which mining operations have been conducted over the district, that Sir Richard Griffith, who wrote his Report in 1814, stated that "the appearance of the surface in every part where the coal was wrought bore a strong resemblance to a rabbit warren, there being a continued succession of hillocks and holes:" he said, "The number of pits that have been sunk may justly be compared to the perforations in a colander."

The Drummagh foot coal has been found in a great number of places, and numerous attempts have been made to work it along the line of its outcrop. The estimated area of the 4-foot coal is about 5000 acres. This coal has the disadvantage of containing a good deal of sulphur, as several bands of iron pyrites are interstratified and disseminated throughout the mass. The kelves which accompany this bed are extensively used for many agricultural purposes, as well as for the burning of lime. The kelves usually sell at the mouth of the pit for 3*s*. or 4*s*. per ton, according to quality. The solid coal of the seam, known as the "upper slate-coal," varies in thickness from 18 inches to 24 inches, and the soft coal from 10 inches to 20 inches. This coal has been extensively wrought at the Ardategle and Tollerton collieries; and it is now generally believed not to be an independent seam, but a continuation of that into which the Firoda shaft was sunk many years ago. The lower slate coal has long been wrought at the Wolf Hill, Clogrennan, Rushes, Moira, and numerous other collieries. The quality of this coal varies considerably at different places; and so numerous are the dislocations of the strata, that the expense of working it has been greatly increased. The thickness of 3 feet which this bed averages is made up of a seam of solid coal which lies at the top, and is 18 inches thick;

3 inches of culm; and a band of kelves, or slate coal, 15 inches thick. The solid coal is said to be an excellent fuel; it is generally free from sulphur, and yields an intense heat if burned when newly raised. Although the Rossmore coal is termed the "foot" coal, it is not of uniform thickness, but, being the lowest seam, it is of considerable extent. It was worked on Rossmore Hill a great number of years ago, but did not pay the expense. It is of a brown colour, and when exposed to the air it becomes reddish. Many attempts have been made to work it, with varying degrees of success.

Throughout the Leinster district there are thirty-one collieries. They are scattered through the counties of Carlow and Kilkenny, and the Queen's County. At present but eighteen of them are at work. They are the Curragh, Massford, Coolbawn, Rock, Monteen, Jarrow, Broompark, and Skehana collieries, near Castlecomer. In the Queen's County there are ten of them at work, namely, the Wolf Hill, Aughamafa, Mullaghmore, Holly Park, Meeragh, Geneva, Glen, Kilgorey, and Coorlaghan collieries. The anthracite which is raised from the pits of the district is a hard, glistening fuel, intermediate in colour between dark brown and black. It sometimes contains a little sulphur and iron, and when ignited it gives out an intense heat; but the disengagement of the sulphur during the progress of combustion often causes an unpleasant odour, and on this account many persons are prejudiced against its use for general domestic purposes. But, notwithstanding this, it is largely employed for cooking, malting, and the manufacture of iron, and is universally regarded as the best fuel for these purposes. At the pits the average price is 20*s*. per ton for the best quality, and the second quality readily sells at 8*d*. and 9*d*. per cwt. Immense quantities of the inferior coal, called culm, are consumed by the country people, as well as by lime-burners and brick-makers. It is a soft and scaly coal, which crumbles on exposure to the atmosphere, although it is raised from the mine in large flakes. When offered for sale, about one-third of its weight of broken anthracite is added to it, and disposed of at 3*d*. and 3½*d*. per cwt. When consumed for domestic purposes, it is usual to mix this culm with clay and water, and knead the whole mass together, and then to form it into a number of balls, which are laid upon the top of the fire. The kelves are a very inferior description of slate coal, only used by the poor when no other fuel can be had; they are of several qualities, but nearly all of them contain over 20 per cent. of sulphuret of iron. These are the three chief varieties of coal which occur in the Leinster district.

The Slieveardagh coal-field, which is a detached area in the county of Tipperary, is included in the coal district of Munster.

In the Slieveardagh coal field there are several collieries at present working, and throughout the neighbourhood there are numberless shallow pits, shafts, and abandoned workings. The Glengoole colliery is situated on the outcrop of the second, or 20-inch seam, a considerable portion of which is already exhausted, but at a short distance towards the south-east there occurs a basin containing five workable

beds, through which the shafts of the Earl's Hill colliery have been sunk. The coal raised at this colliery is a very superior fuel, and readily sells at £1 3*s*. 4*d*. per ton, the price of the culm being 6*s*. 8*d*. per ton. There are several detached basins of small area throughout this district, a few of which have been wrought, and others remain unopened. On one of these small basins the Mardyke colliery was situated, and continued in active operation until the "2-foot seam," into which the shaft was sunk, became exhausted. The beds which lie below this seam are known to extend over a considerable area, and have hardly been worked, although they rise up to the surface in several parts of the district. At Knocknaglass, however, a shaft has been sunk through them, and screened coals, of the best quality, sell at 17*s*. 6*d*. per ton. There are three other qualities, which sell at 15*s*., at 12*s*. 6*d*., and at 10*s*. per ton, respectively. The pits at Boulea, Knockalonga, and Ballingarry Wood, are sunk into the second coal, which varies from 16 to 20 inches in thickness; but as the strata which enclose the seam are much contorted, the expense of extracting the coal is greatly increased. The Old Hill, and the Commons collieries are not at present working.

The district which has been named the Munster coal-field is of enormous superficial extent, and occupies considerable portions of the counties of Clare, Kerry, Limerick, Tipperary, and Cork. The area of the coal-measure formation which spreads over this great district is upwards of 640 square miles, and throughout the extent there are several large basins and outcrops of coal, many of which have been wrought at different periods, and others remain unexplored. The division of the district which extends into the county of Clare is very little known, as the country is in many places covered by large tracts of bog, and the rocks are concealed by drift and other superficial accumulations. In those parts of Clare which have been examined by the officers of the Geological Survey, particularly the parts near the sea coast, several small seams have been observed, two of which are workable, being 18 inches, and 2 feet 7 inches in thickness, respectively. The Munster coal district has been, for convenience, divided into the Clare, Limerick, and Kanturk districts. The Slieveardagh district has been already described. As it is situated in the county of Tipperary, it is regarded as an outlier. It has long been the scene of active mining operations; there are nineteen collieries in it, fourteen of which are at present working—ten of them being owned by the Mining Company of Ireland.

In the Kanturk district, situated in the county of Cork, there are three collieries at work, two of which belong to the same Company. In the Limerick district there are seven collieries, but only two of them are now in a state of activity. South of the Shannon three coal seams have been proved and partly wrought; they are the six-inch seam of good coal, locally known as the "hard seam;" the No. II. coal, or two-foot-six bed, which was worked at the Knocknaboola, Glen, and Rock collieries; and the one-foot-six seam, which is identical with the eighteen inch coal, which occurs in the county of Clare. It is chiefly

culm which is obtained from these seams; but when good coal occurs in the same pit with a seam of culm, both are mixed together by the owner of the colliery, and sold as culm.

The coals of the Limerick district are exclusively anthracite, culm, and kelve. The anthracite is a hard, glistening mineral, which burns well, but occasionally gives off an offensive odour during combustion, in consequence of the disengagement of the sulphur which it contains. The culm is a soft flaky coal, which burns well when mixed with the anthracite.

In the Kanturk district there are six good workable seams, the relative thickness and position of which are—

	Ft.	In.
VI. Coal (Harris's seam),	3	0
V. Coal (Bulk seam),	4	6
IV. Coal (Rock seam),	1	8
III. Coal (Sweet seam),	1	6
II. Coal (Fourpenny seam),	1	2
I. Coal (Castle seam),	0	10

The upper coal of this district, which is locally known as "Harris's seam," has not been as yet much worked. Like most of the coal seams in this district, the bed thins out in some places, and increases to considerable thickness in others. The next bed, or "bulk seam," is a most remarkable deposit, as it has been found, in the course of a few yards' distance, to "bulk," or attain a thickness of 10, 20, and even 30 feet. The "rock seam," or fourth coal, is an excellent bed of anthracite, almost free from sulphur; like the other beds, its thickness frequently varies in short distances, and it has been found to diminish to 9 inches, and to increase frequently to 2 feet.

The most valuable bed in the district is the "sweet seam," from which is obtained an anthracite entirely free from sulphur, and of great heating power. The other two beds are the "fourpenny" and "castle" seams; the former is an anthracite, containing iron pyrites, and has been worked to a small extent, but the latter has not been much touched, as it is an inferior culm.

From this rapid sketch of the character and extent of the Irish coal-fields, we learn that there are 73 collieries at present in Ireland, of which number 31 are in the Leinster district; 29 in Munster; 7 in Connaught; and 6 in the Ulster coal-fields. But of the 73 collieries thus distributed over Ireland, only 46 are at present working. The quantity of coal raised by the Irish collieries is about 120,000 tons annually. In 1863 the exact quantity was 127,570 tons. Although the quantity of coal raised in Ireland is small when compared with the productiveness of the English and Scotch collieries, yet the number of collieries in Ireland is steadily increasing; for in 1853 there were but 19 at work, and in 1856 there were 22 in operation. Small quantities of anthracite and pyritous kelves are shipped occasionally from the ports of Dublin, Cork, Dundalk, and Belfast, to foreign countries. In 1862 the quantity thus exported amounted to 2257 tons, the declared value being £1215.

Of the total quantity of fuel raised by the Irish collieries in 1862, 73,000 tons were anthracite and small coal, and 54,570 tons were bituminous coal.

The fuels consumed in Ireland are chiefly the native peat, coal, and culm, together with large quantities of imported coals. The imports of British coal are considerable, and are increasing, but we cannot state the annual increase exactly. Fuel is one of the primary elements of industry and comfort, and its abundance or scarcity will regulate the extent to which manufactures can be conducted. It is therefore considered one of the great necessaries of life, whether as an article of domestic economy or of national industry. The high price in Ireland of fuel suited to steam-boilers and to many industrial processes has hitherto been supposed to be one of the greatest obstacles to the extension of manufactures. At Glasgow, Leeds, and many other great seats of industry, coals are delivered at the factories for about 5*s*. or 6*s*. per ton, whereas at Dublin and its neighbourhood, the coals cannot be delivered, even at contract rates, under 13*s*. or 14*s*. per ton. This disparity in price affects the interests of a Dublin manufacturer in a manner that will be at once obvious, if we contrast the yearly cost of fuel to a Glasgow manufacturer who consumes 3000 tons of coal annually with the cost to a manufacturer at Dublin who uses the same quantity. The Dublin man pays £2100 annually for his coal, but the man at Glasgow obtains it for £900, and this difference of £1200 a year holds out to the manufacturer a premium for settling at Glasgow in preference to Dublin. The question is often asked, "Why are not the coal mines of Ireland more extensively worked, and their produce brought into competition with the imported coals?" The answer is, that the Irish collieries are worked to as great an extent as local circumstances will admit of, and in their neighbourhood coal may be obtained in as much abundance, and almost as cheaply, as in the most favoured districts of England, Wales, or Scotland. The subsequent increase in the price of the fuel is owing to the cost of the carriage; and whether the system of transit from the collieries to the places of consumption be by road, water, or railway, the additional cost will be influenced by the traffic arrangements of the respective districts. The most expensive mode of conveyance is by horse and dray on the ordinary roads. The charges for this mode of transit are regulated by a great number of local circumstances, such as the state of the roads, the season of the year, the supply of horses above those required for agricultural work, and mainly by having or not having a return load when coming back after the completion of the journey. These and many other circumstances so influence the rates charged for land carriage by horse and dray, that considerable differences exist throughout Ireland, and even in different parts of the same county, in the cost per ton per mile for the conveyance of fuel or other heavy goods. The highest rate that I am acquainted with is 1*s*. 8*d*., and the lowest, 3½*d*. It therefore becomes difficult to strike an average; but, after careful inquiry, I believe that 6*d*. per ton per mile may be regarded as the most usual rate for

carriage by this mode of transit. By the principal lines of railway, the cost of carriage is only 1*d*. per mile for each ton of coals conveyed upon them. The charge upon the Grand Canal is also but 1*d*. per mile for short distances, and for long distances it is as low as $\frac{3}{4}$*d*. Extremely cheap as all of these rates are, they are sufficient to render it impossible that coal from the Connaught or Munster districts can be conveyed from distances of 80 and 120 miles and sold for less than 25*s*. per ton. If all of the Irish collieries were to send their coals to Dublin for sale, there would be great difference in their price. They would probably range from 24*s*. to 30*s*. per ton; for it must be borne in mind, that the best quality of coals is dearer at the mouth of an Irish pit than coals of a corresponding quality are at the pits in England or Scotland. The cause of the difference is chiefly owing to the fact that in the Irish collieries the seams of coal average about 3 feet in thickness, whereas in the English and Scotch collieries the seams are more numerous, and of much greater thickness. In working a narrow seam of coal there is more outlay and less return for the labour, because a considerable quantity of rock must be excavated from the passages through the mine, in order that the workmen may have sufficient headway. But the inferior coals, including culm and kelves, although their extraction is equally as expensive, are generally sold at about the same rate as ordinary coals at the English pits. There is always a brisk demand for the good coal raised from an Irish colliery, because within a radius of several miles around the pit it is much cheaper than the imported coal. The colliery owner may be a monopolist in his district if he choose, and may regulate the price of his coal to the state of the local market. The culm is an inferior fuel for household purposes; it is chiefly used for burning limestone; but when purchased for domestic consumption, a certain proportion of good coal is added to it. Many of the collieries of Leinster are situated within 50 miles of Dublin, and they send to the metropolis, by the Grand Canal, about 2000 tons annually. The coal of the Leinster district, being anthracite, is not suited for domestic consumption in the fire-grates at present in use, but it is a most valuable fuel for many processes connected with the fashioning of iron work, and that which comes up to Dublin is chiefly used by smiths and maltsters.

The Irish Parliament made strenuous exertions to stimulate and encourage the working of the coal mines of Ireland, and the local consumption of their produce. Large grants were given for the construction of roads and the erection of machinery, to render them accessible and efficient, and a bounty of 2*s*. per ton was awarded to all Irish coal brought coastwise to Dublin, at the same time that a duty of 10$\frac{1}{2}$*d*. per ton was imposed upon all British fuel imported. There is now no coasting trade in Irish coals, but there is a very extensive cross-channel trade in British coals, which employs a considerable amount of shipping. The vessels engaged in the trade are numerous brigs, and a few steamers. Owing to the prevalence of westerly winds during nearly nine months of the year, the coal brigs employed in this import trade are subject to all the delays and hazards incidental to the channel navigation; but beyond

occasional detention by adverse winds there is no interruption to the traffic, which is a most lucrative one, and in which is invested nearly £2,000,000 sterling.

In 1821 an Act of Parliament was passed which imposed a duty of 1*s.* 7½*d.* per ton on Irish coal brought coastwise to Dublin. The trade soon afterwards ceased, but the coal from the Ballycastle collieries continued for a few years to be exported to Scotland. In 1825 the duties on the cross-channel trade were abolished, and since that period we have no returns, nor the means of estimating the exports and imports to and from Great Britain; consequently, we cannot by the usual direct and reliable means of official returns tell precisely what quantity of British coal is consumed in Ireland. The coasting duty on coal was shortly afterwards abolished in 1830. When we consider the enormous extent of the coal area of the British Islands, an area of upwards of 12,000 square miles, 2,000 of which are in Ireland, we observe at once the great national advantages which these stores of fuel confer upon the country. The produce of the English collieries amounted last year (1863) to 72,431,144 tons; the produce of the collieries of Scotland, to 11,081,000 tons; those of Ireland yielded 127,570 tons; and the total quantity of coal raised in the United Kingdom was 83,635,214 tons. The most productive counties in England are Durham and Northumberland, which yield yearly upwards of 19,000,000 tons. Lancashire is the next, yielding considerably more than 12,000,000, and in Yorkshire about 10,000,000 tons were raised during the past year. In England and Wales there are 2555 collieries at present in activity, and 424 in Scotland, the total number in the United Kingdom being 3052. From some cause or other, probably the stoppage of many of the cotton mills, the total quantity of coals raised in 1862 fell in England and Wales about 2,000,000 tons, but in Ireland during the same year there was an increase of about 4,000 tons. The total exports of coal from Scotland is considerably over a million and a half of tons. The exports from English and Welsh ports is still more considerable, and the coasting trade enormous. This will be seen from a glance at some of the returns. From Whitehaven, in 1862, there were exported 194,432 tons; from Workington, 144,294; and from Maryport, 382,725 tons. The value of the coal raised and consumed in the United Kingdom amounts to £21,000,000 sterling annually, and the capital invested in the trade is about £10,000,000.

The importance of this trade is at once understood when we learn that the coal raised within the United Kingdom during the past few years represents more than ten times the money value of any of the metallic mines, or any mineral substance raised within the same area, and that the number of men employed as miners in the coal pits is considerably over 240,000.

It is less than a century ago since coal began to be regularly imported into Ireland. In 1783 the quantity was 230,140 tons, and in 1804 it amounted to 417,030 tons. These importations have increased amazingly, not only for consumption in the seaport towns, but to meet

the requirements of many of the inland districts. During the past year, 57,487 tons of imported coals were conveyed from Dublin to the interior by the Grand Canal Company's boats, being an increase over the previous year, in which the quantity was 54,523, and this again an increase over 1861, in which year the quantity was but 48,533 tons. I am indebted for these instructive figures to the kindness of the Directors of the Grand Canal Company, and, as they have never before been made public, they have a peculiar value.

With regard to fuel, London is similarly circumstanced to Dublin. The bulk of the coal consumed in London is sea-borne, and the remainder is conveyed by railways. Coal is much dearer in London than in Dublin, and, notwithstanding the fact, the number of trades and manufactures carried on with profit in that gigantic city is truly astonishing. The transit arrangements for the supply of the city with coal are of a very superior character, and the activity of competition has reduced the cost of carriage to the lowest remunerative amount; but in the London coal market there are several dues and charges imposed upon the article which are unknown in Dublin. In London the market or ship price includes—

	s.	d.
City dues,	1	1
Factorage,	0	4
Half weighing,	0	1½
Total,	1	6½

To the London market price is added—

	s.	d.
Lighterage from ship,	0	6
Porterage from barge,	0	10
Loss on small coal,	1	6
Cartage and shooting,	2	6
Wharf and office,	0	6
	5	10
Less discount to buyer,	0	6
Total,	6	10½

These charges bring the cost of many kinds of house coal up to 18*s*. 6*d*. per ton. The cheapest are the Newcastle and Sunderland coals, which range at about 16*s*. per ton, and the dearest are the Welsh, which sell retail at 23*s*. 6*d*. per ton.

A considerable impetus would be given to the consumption of Irish coal if the transit arrangements now existing were improved. This could be effected by connecting the collieries and railways by special tramway lines, and adopting generally the efficient transit systems so successful in England. According to the modern plan of sending the produce of a coal mine to market, the fuel, as soon as it is hoisted up from the pit, is screened and tumbled into a train of waggons at one operation, and then rolled off upon a tramway to the nearest railway.

The gauge of the tramway and the railway is the same, and, both being in connexion, there is not a moment's delay in the shunting of the waggons. The train then proceeds towards its destination; and if the railway does not exactly pass through the premises of the manufacturer to whom the coals are to be delivered, or proceed all the way to the side of the ship in which they are to be exported, the train leaves it by a short tramway, similar to that by which it entered, and quickly drops its load at the door of the workshop, or into the hold of the ship. By such arrangements, the cost of carriage is reduced to the lowest amount, and the tedious, costly, and wasteful system of loading and unloading half a dozen times in the course of a single journey dispensed with.

For many years past it has been the custom with the principal Irish railway companies to import British coal, and from it to make the coke used by their locomotives engines. This coke is prepared in two ways—by burning in heaps in the open air, and by conducting the operation in ovens built for the purpose. About 40,000 chaldrons of coke are available for consumption annually from the two gas companies in Dublin. The coke from the gas works, being light and porous, is not suitable for steam-engines, but it is an excellent and cheap fuel for stoves and cooking purposes. The railway companies are beginning to give up the manufacture of their own coke, as they find the Welsh, or steam, coal better adapted to their engines.

The return which I have obtained from the Grand Canal Company of the fuel traffic on their canal states the quantity of turf brought from the interior to Dublin to be 24,638 tons in 1863, and to average about 23,000 tons annually. The cost of carriage on turf is $1\frac{1}{4}d.$ per ton per mile, which is higher than the rate charged for coal. The turf which is brought to Dublin by the Grand and Royal Canals is consumed chiefly by the poorer classes. Around the city, and along the banks of the canals, there are numerous depôts for the sale of the turf. It is sold retail by bulk, and the rate at which it is sold is equivalent to 10*s.* 9*d.* per ton. The poor who consume it purchase it in very small quantities; but if large quantities were ordered, the vendors could sell it at 9*s.* 8*d.* per ton, and have a reasonable profit. The burden of the open boats, or barges, which bring the fuel to Dublin is usually 55 tons. As the turf is at present prepared and sent to the Dublin market, it is a very inferior fuel. Being, for the most part, spongy and porous, it retains the moisture which it imbibes from constant exposure to the atmosphere. It is bulky, and the shape of the "sods," although very convenient for transit, is unsuitable for general use. Our distinguished countryman, Mallet, has calculated that eighteen or nineteen sods of turf are equivalent as fuel to a cubic foot of wood. The quality of turf as a fuel could be greatly improved if it were kiln-dried, and afterwards kept under cover from the inclemency of the weather. In every improvement which has to be effected in any process, there is always some old prejudice to be overcome. Any improvement which may hereafter be made in the cutting and saving of turf must be commenced by the landowners, and carried out under their own superintendence, or that of

their stewards. Turf-making is like sea-fishing. Dependence for employment upon the state of the weather has a tendency to induce lazy habits. In Ireland we have wet seasons frequently, and during their continuance a considerable amount of labour is wasted by the poor peasant in the most wretched endeavours to procure a supply of fuel for the winter. A crop of turf gleaned under these circumstances is in the worst possible condition for use, and the cheerless hearth of a damp cabin is too gloomy a subject for a picture. Unfortunately, in nearly all of the attempts hitherto made at improving the quality of turf and reclaiming the bogs, expensive machinery formed a feature of the various plans, and materials had to be brought from considerable distances. Mr. Mallet, in a valuable paper on the preparation of turf, which he published in 1845, recommends the construction of a simple and cheap form of kiln, the walls and roof of which are built externally of turf sods. This form of kiln has been tried by several landed proprietors, and found to answer its purpose admirably. There is another process for the preparation of peat, which is at present practised in a few rural districts by the poor; it is similar in principle to the plan adopted in Holland for making hand turf. A hole or open drain is dug in a wet portion of the bog, and the muddy matter which settles at the bottom is lifted up, trodden upon with the feet until reduced to a pulp, dried in the sun, and shaped into cubical or spherical forms by the hands. The peat thus prepared dries much faster, and is more than twice the density of the peat cut from the turf bank in the ordinary way. The introduction of the Dutch method of turf-making into this country would be fraught with many advantages; a better fuel would be produced, irrespective of the state of the weather; women and children could be employed in its preparation; and the material being plastic in the hands of the operator, it could be moulded into suitable shapes for any special purpose. The Dutch cut through the centre of the marsh a canal of sufficient width to allow a large raft to float upon the surface. The denser particles of the peat sink to the bottom of the water, and the sediment so formed is lifted up with a kind of scoop by a man on the raft. The matter is deposited upon the banks in a row of small heaps, where it remains for a few days to drain. After the heaps have been trampled upon by a number of boys, who wear wooden shoes, it becomes plastic, and is then moulded into suitable forms for use. Prepared in this way, the peat dries rapidly in a current of air, and becomes extremely dense. The only objection to this mode of preparing peat for fuel is, that the boys expend a good deal of labour. I do not intend to advocate the exact imitation of the Dutch method in Ireland, but I suggest that the principle involved in the process may be taken advantage of, and applied to machinery. I have been favoured by Mr. John Kelly, C. E., Roscommon, with a number of samples which possess considerable interest, as they are of a useful character, and have been produced under circumstances which fulfil the conditions essential to the successful production of a cheap and abundant fuel. Mr. Kelly's samples are further

interesting from the fact, that amongst them are drainage pipes made of the peat itself. The idea of making these pipes of peat is, I believe, original. They are made independent of skilled labour, without machinery, and can be produced in endless quantity at a very cheap rate. Rude as they appear, they are well adapted to their purpose. I have been informed by an eminent engineer, who has conducted extensive drainage works in the west of Ireland, that peat is an excellent material for constructing drains. The ordinary stone drains frequently become choked by roots and other obstructions penetrating through their interstices, but peat appears to possess some property not yet investigated, of resisting the growth of roots through its substance. The cheap rate at which these pipes may be produced, and the simple mode of their manufacture, entitle them to much notice, as one of the chief objections to the reclamation of bogs arises from the apprehension of a considerable outlay. The other samples produced by Mr. Kelly are remarkable, as they show that a dense peat may be obtained without pressure, skilled labour, or expensive machinery. The idea of making drainage pipes of peat instead of terra cotta, is novel; and if after trial these pipes be found to answer their purpose, we may hope to see many thousand acres of profitless wastes reclaimed and added to the tillage lands of the country. There is, probably, no subject on which such diversity of opinion exists as on the reclamation of bog lands. Some persons advocate drainage, and others assert that drainage will not prove beneficial. In some districts the bogs are valued at ½*d.* an acre, in others they bring a rent varying from 5*s.* to £1 an acre. As turbaries, £6 per acre yearly is considered a reasonable rent, and instances are common of £80 per acre being obtained as purchase money for small tracts of bog. Such being the facts, we must bear in mind that local circumstances will not only influence the value of a peat marsh, but will modify the plan which should be adopted for its reclamation. As a general rule, it may be stated that all peat marshes will be benefited by being intersected by a wide and deep drain to remove the surface and bottom waters. In a great many instances minor drains may be introduced with advantage; but it often happens, owing to the spongy and retentive nature of peat moss, that much of the moisture which saturates the bog will not be discharged by the drains, because it will not leave the peat. This is a character common to nearly all of the morasses in Ireland; but there is a wide range of variation in the extent to which each exhibits it. The most successful system of reclamation has been found to be partial drainage, and a surface covering of earth and limestone gravel. But so diverse are the local conditions, that a system which may have been adopted with success in one district will often be found inapplicable in another. With partial drainage and a surface covering of clay the peat contracts, and, becoming more dense, the level of the surface falls about three inches for every foot of depth. The quality of the peat for fuel is thus very much enhanced; and as the surface is capable of cultivation, much good may be effected by any improvements undertaken with a view to turn these bogs to profitable account. From the varied con-

ditions of their extent, wetness, and local value, no system of reclamation can safely be recommended as generally applicable, and whatever course may be adopted in their treatment must be the result of local knowledge influenced by local considerations. The fact, however, is certain, that a most valuable fuel is not economized, and that 2,000,000 acres are lying neglected.

In closing this investigation, I have to state that I have arrived at the following conclusions :—

1. That there is a great scarcity of timber in Ireland, and that this scarcity should be overcome by increasing the number of plantations.

2. That the quantity of peat in Ireland is enormous, but that the manner of preparing it for fuel, as practised by the peasantry, is extremely rude and expensive.

3. That the coal mines of Ireland are far from being exhausted; that they are worked to a very large extent; and from their present condition, there is every prospect that increased supplies will be obtained from them.

4. That the proximity of the eastern coast of Ireland to the British ports from whence immense quantities of coal are shipped, and the lowness of freight between the British and Irish ports, offer facilities for supplying Ireland with British coals, and competing at present with the produce of the Irish collieries.

5. That the trade in coals between Great Britain and Ireland is now free from legislative restrictions, and that the competition between the produce of the two countries is of a purely commercial character.

6. That in the immediate neighbourhood of many of the Irish collieries coal and culm are extremely cheap and abundant; in the neighbourhood of the bogs turf is likewise abundant; and at the principal Irish seaports every description of British coal is regularly delivered by fleets of vessels engaged in the trade.

7. That a considerable impetus would be given to the consumption of Irish coal, if the improved machinery and systems of transit applied in England were adopted in Ireland.

I have also to make the following recommendation :—

That as the supply of fuel which may be obtained from the peat marshes is almost inexhaustible, and capable, when skilfully treated, of being rendered a most valuable addition to the national wealth, that attention should be directed—

1. To the partial drainage of the bogs in localities where bog lands are numerous and of great extent.

2. To the necessity and advantage of landed proprietors erecting the cheap and useful kilns for drying turf which were designed by Mr. Mallet and the late Mr. Tredgold. Kilns erected in suitable localities may not only serve the use of several tenants, but also the use of the proprietor himself.

3. The encouragement and assistance of every person interested in the prosperity of the country, to carry into effect such feasible and in-

expensive plans for the compression of peat by machinery as are likely to prove successful.

4. The general introduction into populous localities of the Dutch method of making turf. By this process an immense amount of employment may be afforded to women and children at nearly all seasons of the year, and the labour of men, which under the existing system of turf-cutting is much wasted, economized. By this process, also, a better fuel may be obtained, at less cost than at present.

APPENDIX.

No. I.

"*Grand Canal Harbour, March* 21, 1864.

"SIR,—We beg to note the prices of Kilkenny coals:—

	Per Ton. s.	d.
First quality, delivered at Athy or Carlow,	25	0
Second do., do., do.,	23	4
Third do. (Jarrow), do., do.,	17	6
Fourth do. (Wolfhill), do., do.,	13	6

For prices in Dublin, add 5*s*. 6*d*. per ton to the above prices.

"JOHN KELLY AND SONS.

"*H. O'Hara, Esq.*, 51, *Stephen's-green*."

No. II.

COLLIERIES OF IRELAND.

I. ULSTER COAL-FIELD.

Co. Antrim.

Name.	Proprietors.
1. Ballycastle,	— Boyd, Esq.
2. Murlough Bay, *not* W.*	J. M'Donnell, Esq.

Co. Tyrone.

1. Annahone, *not* W.,	—
2. Coal Island,	Messrs. Staples.
3. Drumglass, W.,	T. Hughes, Esq.

Co. Cavan.

1. Kill, *not* W.,	Moore and Co.

* W. signifies that the colliery is at present working; and *not* W. implies that it was not in operation at the time this list was prepared.

II. Connaught Coal-Field.

(Lough Allen District.)

Counties of Leitrim, Sligo, and Roscommon.

Name.	Proprietors.
1. Tullynaha, W.,	P. Buchanan, Esq.
2. Tullymurry, W.,	Do.
3. Seltanaskeagh, W.,	Do.
4. Meenashammer, W.,	W. Cronyn, Esq.
5. Gobarudda, W.,	E. M'Dermott, Esq.
6. Geevagh, W.,	Different Colliers, on their own account.
7. Greagnageeragh, W.,	

III. Leinster Coal-Field.

(Castlecomer District.)

Co. Kilkenny.

1. Curragh, W.,	Hon. Mr. Wandesforde.
2. Massford, W.,	Do.
3. Coolbawn, W.,	Do.
4. Rock, W.,	Do.
5. Monteen, W.,	Do.
6. Jarrow, W.,	Do.
7. Upper Reisk, *not* W.,	Pat. Fenlon.
8. Broom Park, W.,	Do.
9. Crutt, *not* W.,	Hon. Mr. Wandesforde.
10. Monala, *not* W.,	Do.
11. Skehana, W.,	Do.
12. Firoda, *not* W.,	— Freyke, Esq.
13. Banshafea, *not* W.,	Lord Ormonde.
14. Coolcullen, *not* W.,	M. Phillips.

Carlow and Queen's County Collieries.

1. Bilboa, W.,	H. Rochfort, Esq.
2. Agharne, *not* W.,	Sir J. Butler.
3. Ridge,	Mr. Phillips.

Queen's County.

1. Wolfhill, W.,	Perrot and Co.
2. Aughamafa, W.,	Do.
3. Mullaghmore, W.,	Do.
4. Kingscote, *not* W.,	Rev. Sir H. Walshe.

Queen's County continued.

Name.	Proprietors.
5. Modubea, *not* W.,	Perrot and Co.
6. Rushes, *not* W.,	Rev. Sir H. Walshe.
7. Holly Park,	B. B. Edge, Esq.
8. Meeragh, W.,	Do.
9. Geneva, W.,	Do.
10. Glen, W.,	Do.
11. Towlerton, *not* W.,	W. Edge, Esq.
12. Kilgorey, W.,	B. B. Edge, Esq.
13. Ardataggle, *not* W.,	T. Fitzmaurice, Esq.
14. Coorlaghan, W.,	Do.

IV. MUNSTER COAL-FIELDS.

(Slieveardagh District.)

Co. Tipperary.

1. Coalbrook, W.,	Mining Company of Ireland.
2. Boulea, W.,	Mining Company of Ireland.
3. Knockalonga, W.,	Mining Company of Ireland.
4. Earl's Hill, W.,	Mining Company of Ireland.
5. Ballynastick, W.,	Mining Company of Ireland.
6. Ballynahinneen, *not* W.,	Mining Company of Ireland.
7. Mardyke, *not* W.,	Mining Company of Ireland.
8. Coolquill, *not* W.,	Mining Company of Ireland.
9. Glangoole, W.,	Mining Company of Ireland.
10. Lickflinn, *not* W.,	Mining Company of Ireland.
11. Garranacole, W.,	Mining Company of Ireland.
12. The Wood Colliery, W.,	Beatty and Co.
13. Ballincurry, W.,	Mining Co. of Ireland.
14. Foyleacamin, *not* W.,	Meadows and Co.
15. Knockinglass, W.,	Do.
16. Kilcooly, W.,	Mining Co. of Ireland.
17. Ballynenty, W.,	Do.
18. Manslat, W.,	Meadows and Co.
19. Graigue, W.,	Do.

(Kanturk District.)

Co. Cork.

1. Dromagh, W.,	N. P. Leader, Esq.
2. Lisnacon, W.,	Mining Co. of Ireland.
3. Drumskehey, W.,	Mining Co. of Ireland.

(Limerick District.)

Co. Limerick.

Name.	Proprietors.
1. Tulligoline, W., ...	Lord Devon.
2. Crataloe, W., ...	Archdeacon Gould.
3. Sugarhill, *not* W., ...	Mr. Maunsell.
4. Kockaboula, *not* W., ...	Lord Clare.
5. Coalhill, *not* W., ...	Do.
6. Rockview, *not* W., ...	Do.
7. Glin, *not* W., ...	Knight of Glin.

XXII.—*On Albumin and certain of its Metallic Combinations.* By EMERSON J. REYNOLDS.

[Read April 18, 1864.]

IN the paper which I now lay before the Society I give the results of an investigation on Ovalbumin and certain of its metallic combinations, undertaken some time ago, with the primary object in view of making out the theory involved in the process of preparing albuminised paper for sun-printing, and likewise of examining some of the chemical relations of the argento-albuminous compounds. The more purely practical results which I obtained have been discussed in another place.* It is mainly with theory, deduced from experiment, that I shall now occupy your attention.

At the outset it was necessary to obtain definite information regarding the properties and composition of pure albumin, both in the soluble and coagulated modifications.

Pure and soluble albumin was prepared by two different methods:— *a*. As described by Wurtz,† by precipitating white of egg, previously beaten, diluted and strained, with basic acetate of lead, then washing the precipitate, suspending it in distilled water, and decomposing it with a current of carbonic acid; next filtering through well-washed paper, treating the filtrate with an excess of sulphuretted hydrogen; then warming until a slight coagulum was formed, in order to carry down the suspended sulphide of lead, and finally again filtering. The colourless solution, thus prepared, contained only pure and soluble albumin, which could be obtained in the solid state by evaporating to dryness *in vacuo*. *b*. I have based the second process on the fact, that *insoluble*, but not coagulated albumin, is readily dissolved by a strong solution of nitre. White of egg is well agitated with twice its volume of water, and then

* "British Journal of Photography."

† "Ann. Ch. Phys." [3] xii., 27.

filtered through linen. The filtrate is now accurately neutralized with very dilute acetic acid, and then largely diluted with water. This causes the precipitation of flocculi of albumin, which must be thoroughly washed, and then digested in a strong and pure solution of nitrate of potassium. The solution is now dialysed until a drop of the liquid on the dialyser, when evaporated to dryness, and ignited, leaves no fixed residue. In this process the nitre diffuses into the external water, leaving the albumin behind.

When freshly prepared by either method, a solution of albumin has a very faint *acid* reaction, and is coagulated with the greatest facility, simple agitation of the liquid being frequently sufficient to bring about the change. In most respects its reactions are very similar to those of ordinary white of egg.

The composition of albumin has been carefully studied by many chemists; but it will suffice to notice here the results obtained by three experimenters, viz., Mulder, Wurtz, and Lieberkühn. Subjoined I give their analyses. The results of Mulder and Lieberkühn were obtained with pure and dry coagulated albumin from hens' eggs; those of Wurtz with pure and dry soluble albumin, from the same source:—

	Calculated from Lieberkühn's Formula.		Mulder.	Lieberkühn.	Wurtz.
*C_{72},	864	53·59	53·4	53·3	52·9
H_{112},	112	6·95	7·0	7·1	7·2
N_{18},	252	15·64	15·7	15·7	15·6
S,	32	1·98	. . .	1·8	. . .
O_{22},	352	21·84	. . .	22·1	. . .
	1612	100·00	. . .	100·0	. . .

Most chemists deny the existence of unoxidized phosphorus in albumin.

From these and other analyses, Lieberkühn deduces the formula—

$$C_{72}H_{112}N_{18}SO_{22},$$

which may obviously be written—

$$\left.\begin{matrix}(C_{72}H_{110}N_{18}SO_{20})'' \\ H_2\end{matrix}\right\} O_2.$$

As the centesimal composition required by the formula agrees nearly with the experimental numbers, and appears to be borne out by analyses of many of the salts, we may look upon albumin as a feeble and apparently dibasic acid, capable of forming neutral and acid salts. Several of these saline combinations I have carefully analysed, and shall describe further on.

* C = 12; O = 16; S = 32; N = 14.

Action of Heat on Albumin in solution, and in the dry state.—The coagulation of albumin has given rise to much discussion concerning its cause amongst those chemists who have occupied themselves with the study of the chemical history of that body. One view in particular, regarding the cause of its coagulation by heat, has been urged principally by Gerhardt.* On this view, albumin, as it exists in the white of egg, is regarded as acid albuminate of sodium. When a solution containing this body is boiled, an atom of the metallic oxide is replaced by a molecule of water—thus giving rise to the so-called albuminic acid, which is thrown down. This theory is apparently strengthened by the fact, that a solution containing white of egg is more strongly alkaline after than before coagulation. On the other hand, it must not be overlooked that a solution of albumin from which all trace of alkali has been removed with the greatest care can be likewise coagulated by heat—in fact, when in this pure state, very slight physical changes are sufficient to bring about coagulation, as I have frequently observed when filtering solutions of pure albumin, that on allowing the liquid to fall into the receiver from a height of twelve inches or so coagula of albumin are thrown down. Such being the case, I think there can be little difficulty in constructing a theory based on the assumption that the soluble form is the unstable and the coagulated the stable modifications of albumin†—thus explaining coagulation on physical grounds, without confining ourselves to any particular views regarding the chemical constitution of albumin.

It is well known that albuminous liquids, containing a small quantity of alkali, are easily coagulated by heat; but by increasing the amount of alkali a point is arrived at when the influence of the physical agent is *nil.* If then we regard a solution of pure albumin as being in a state of unstable equilibrium, capable of being upset by very slight physical causes, the addition of a minute trace of alkali to such a liquid tends to throw the balance on the side of permanent solution, for then mere agitation or friction is not able to overcome the influence of the alkali;‡ but if we apply the more powerful physical agent (heat), the obstacle is easily surmounted, and the result is coagulation. Let us now go a step further and add a still larger proportion of alkali; we then find that even the highest temperature to which the mixture can be brought is insufficient to produce coagulation, owing probably to the intensity of the physical agent being too low to overcome the affinity existing between the acid and base. If, however, a neutral salt, such as nitrate of potassium, or sulphate of sodium, be added, the boiling point is raised,

---

* "Traité de Chemie Organique," iv., 448.

† It will be remembered, of course, that the most careful analysis does not show any real difference in the centesimal composition of either soluble, insoluble, or coagulated albumin.

‡ In an experiment of this kind it will be observed, that the amount of alkali required to produce the effect described does not amount to more than the $\frac{1}{100}$dth part of the equivalent of base with which the whole of the albumin present could combine.

the intensity of the physical force is increased proportionally, and the result again is coagulation.

As but little is known of the action of heat on *dried* soluble albumin, I have carefully investigated the changes which it undergoes at different temperatures, as this is a matter of considerable interest in connexion with photography on paper.

The experiments now to be cited are selected from many others, as affording the most direct proof of the influence of increase of temperature on ovalbumin. Some white of egg was well whisked, then strained through muslin, and evaporated to dryness *in vacuo* over sulphuric acid; the brittle residue was coarsely powdered, and dried at 212° F. for nine hours, then finely powdered and preserved for use. Six small glass tubes, closed at one end, were now prepared, and equal quantities of the dry white of egg placed in each; these were then treated as follows:—1. Was not heated, but set aside for comparison. 2. Heated in an oil bath for fifty minutes to 240° F. At this temperature an additional quantity of water was given off. 3. Heated for sixty-five minutes to between 290° and 310° F., the powder became of a pale buff-colour. 4. Heated for sixty minutes to between 340° and 360°, colour rather deepened in tint. 5. Heated to between 400° and 420°, for thirty minutes—the result of this experiment was a deep-brown powder, which gave evidence of approaching decomposition. At a temperature of about 50° higher, the white of egg commenced to char rapidly.

After each specimen was allowed to digest in the cold with distilled water for two days the following observations were made:—1. The white of egg had swollen to nearly eight times its original bulk, and a considerable quantity of albumin had passed into solution; 2. The powder had increased by nearly three times its former bulk, and some albumin was dissolved out, though less than in the last case; 3 and 4, increased but little in volume, and *no albumin* could be detected in the water;* 5. Partial decomposition had set in, and a caramel-like body was dissolved out by water; Nos. 3 and 4 were then digested with a strong solution of nitrate of potassium, but no trace of albumin was dissolved out.

From the results of these experiments we learn:—1st, that dried white of egg, when kept at 212° for nine hours, is not altered to any material extent in its general relations; 2ndly, when heated to 240°, it undergoes a perceptible though not important change; 3rdly, at temperatures ranging over at least 60° F. (between 300° and 360°), the albumin is rendered totally insoluble in water and solution of nitrate of potassium,—thus almost necessitating the conclusion, that it had passed into the coagulated modification; and, 4thly, at temperatures above 400° it commences to decompose.

* Nos. 1 and 2 gave abundant evidence of the presence of albumin by simply heating with nitric acid. Nos. 3 and 4 were examined with Millon's acid nitrate of mercury test, but without any positive result.

A parallel series of experiments were made with pure soluble albumin; and it was found that it became insoluble when heated for an hour to a temperature of 230° F., and commenced to decompose at about 370° F.

Albumin in Combination.—As already mentioned, albumin may be regarded as a feeble dibasic acid, consequently the formulæ of its salts may be either—

$$\left.\begin{matrix}(C_{72}\,H_{110}\,N_{18}\,SO_{20})'' \\ MH\end{matrix}\right\}O_2,$$

the acid salts; or

$$\left.\begin{matrix}(C_{72}\,H_{110}\,N_{18}\,SO_{20})'' \\ M_2\end{matrix}\right\}O_2$$

the neutral compounds. Experiment seems to show that all the salts have a molecule of water superadded.

Potassium Salt.—This was prepared easily, and in a state of comparative purity, by adding strong potash solution to white of egg, previously whisked and strained. The stiff mass so produced was broken up and thoroughly washed,* as Lieberkühn directs. The composition of this compound, I found, could be most simply and accurately determined in the following way:—The mass was dissolved in boiling water, and the solution allowed to cool down to the normal temperature. A certain volume was then placed in a flask, and boiled, with the addition of a slight excess of pure acetic acid; this precipitated the albumin in a convenient form, which was then thoroughly washed, dried *in vacuo* over sulphuric acid, and weighed. The filtrate and washings were then evaporated nearly to dryness, with the addition of excess of pure hydrochloric acid, and the potassium determined in the usual way as platino-chloride. From these data the centesimal composition was then calculated.

These analyses gave—

	1.	2.	3.
K	4·231 . . .	4·402 . . .	4·686
			Theory 4·57 per cent.

The preparations analyzed were made at different times. Considering the ill-defined nature of the compound, these determinations may be considered fair approximations to the formula—

$$C_{72}\,H_{110}\,N_{18}\,SO_{22}\,K_2 + H_2O.$$

Sodium Salt.—Gerhardt supposes the white of egg to consist of the albuminate of sodium. This hypothesis appears to be strengthened by

* The washing of most of the compounds was effected under pressure, as this was found to be the only effectual means for removing soluble impurities in a reasonable time.

the determinations of the alkali usually contained in white of egg. Lehmann found 1·157 per cent. Na as a maximum, and a mean of three closely concordant determinations, made in the autumn of 1862, gave me 1·034 per cent. Theory requires 1·39 per cent. Na, according to the formula,

$$C_{72}H_{110}N_{18}SO_{22}HNa + H_2O.$$

Whatever may be the view ultimately taken in regard to the chemical constitution of white of egg, the fact is clear, that for a given group of atoms represented by Lieberkühn's formulæ, white of egg contains but one atom of sodium for the two of potassium contained in the salt first noticed. This is a point of some importance, as it enables us very easily to explain the reaction of nitrate of silver and metallic salts generally on white of egg, though it appears to have escaped the attention of previous experimentalists working on the argento-albuminous compounds. However, this can be more suitably discussed further on.

A neutral sodium compound can be formed; but its properties are so similar to neutral albuminate of potassium, that it needs no further notice.

Silver Salts.—It is well known that the addition of a solution of a metallic salt, such as nitrate of silver, to white of egg, causes the precipitation of an apparent coagulum. The composition of these precipitates we may now examine.

Lieberkühn has described a neutral silver salt obtained by precipitation from the potassium compound, with nitrate of silver in slight excess. The formula of this compound is given below. I find that by keeping the albuminate of potassium largely in excess of the nitrate of silver, an acid salt can be obtained. Both these argento-albuminous compounds, neutral and acid, are soluble in hyposulphite of soda solution; but the acid albuminate is much less easily soluble than the neutral salt. They are likewise quickly dissolved by ammonia. In making determinations of the silver contained in these and similar compounds, the following simple and accurate method was employed:—A known weight of the dry compound was allowed to macerate in water for two hours; some ammonia was then added, and the whole digested until complete solution had taken place; the liquid was next considerably diluted, and the temperature raised to near the boiling point; an excess of strongly ammoniacal dichloride of copper was then poured in, and the mixture allowed to digest for half an hour, at a gentle heat. After standing for some hours, in order to allow the finer particles to subside, the liquid was filtered off, and the precipitate washed, dried, ignited, and weighed as pure silver. This method, which gives very accurate results, is based on the observation of Millon and Commaille, that ammoniacal dichloride of copper is capable of completely reducing the metal from ammonio-nitrate of silver. I find that the same is true for the ammoniacal solutions of argento-albuminous compounds. The neutral albuminate gave the following results:—

a. 31·77 grs. gave 3·564 grs. of silver = 11·21 per cent. Ag.
b. 27·83 grs. gave 3·147 grs. of silver = 11·30 per cent. Ag.
Theory requires = 11·72 per cent. Ag.

These results give probability to the formula—

$$C_{72}H_{110}N_{16}SO_{22}Ag_2 + H_2O.$$

The acid albuminate yielded the following numbers on analysis:—

a. 38·33 grs. gave 2·284 grs. of silver = 5·95 per cent. Ag.
b. 32·10 grs. gave 1·929 grs. of silver = 6·01 per cent. Ag.
Theory requires = 6·21 per cent. Ag.

From these experiments, it would seem that the new albuminate is a true acid salt of the formula—

$$C_{72}H_{110}N_{18}SO_{22}AgH + H_2O.$$

Knowing these facts, then, we are in a position to understand the reaction which takes place on mixing white of egg with excess of nitrate of silver. Assuming, as we may do with some reason, that white of egg is a solution of acid albuminate of sodium, we can easily understand that when a molecule of it reacts with two molecules of nitrate of silver, the products of the reaction are one atom of neutral albuminate of silver, one of nitrate of sodium, and an atom of nitric acid. The latter, coming in contact with another portion of white of egg, coagulates a part of the albumin, at the same time the acid is carried down in the coagulum.

We can now easily explain the recent observation of Davanne and Girard, that the more dilute the silver solution used to precipitate white of egg, the richer is the resulting albuminous compound in silver. It is obvious that the more dilute the solutions used, there will be proportionally smaller quantities of the two bodies to react in a given volume; consequently, the nitric acid set free is in a more dilute state; and since a weak acid coagulates albumin but slowly, it follows that the precipitate of argento-albuminous compound must be richer in silver, and poorer in albumin, than if it were produced from more concentrated solutions.

I have made many experiments in this direction, the results of all of which tend strongly to sustain the view already expressed. I shall here merely mention two, as illustrating most clearly the influence of the acid. It was found that the product of the action of a solution containing 15 per cent. of neutral nitrate of silver was but partially soluble in strong solution of hyposulphite of sodium. However, as the strength of the argentine solution diminished, the amount of residue insoluble in hyposulphite of sodium was likewise reduced in quantity, until a point was arrived at when the silver compound was completely soluble. In making these

experiments it was observed that if a considerable time elapsed between the formation of the silver compound and the addition of the solvent, the amount of insoluble matter had greatly increased in quantity.

Another set of experiments were made, in which there was practically no dilution of any of the solutions, but the proportion of alkali in the white of egg was gradually increased. It was found that as the amount of alkali increased, the quantity of coagulum diminished, until the solution in hyposulphite of sodium was nearly complete.

It is hoped that these observations may help to clear away some of the difficulty which has hitherto been connected with the investigation of the action of metallic salts on albumin.

XXIII.—*On the Chemistry of the Feeding of Animals for the Production of Meat and Manure.* By MR. J. B. LAWES.

[Read March 31, 1864.]

THE breeding and feeding of stock must always constitute an important branch of the agricultural practice of this Island. With a climate rarely so hot and dry in summer, or so cold in winter, as to materially arrest vegetation, Ireland may not less truly than poetically be styled the Emerald Isle. A succession of seasons more than usually unfavourable for grain crops has greatly reduced the profits, and even the capital, of many of your farmers. It is natural, therefore, that there should be, at the present time, more attention directed to the production of meat, and less to the growth of corn; more especially as with the declining price of grain that of meat has considerably advanced, and has probably not yet reached its highest point.

Although the application of science to agriculture is not generally regarded with much favour by practical farmers, there are still very many who feel how advantageous it would be to know more of the rationale of their operations than they do at present. The scientific principles involved even in old-established practices are frequently but little understood; whilst farming is every year becoming less and less of a mere routine business than it was formerly: new foods, new manures, improved descriptions of stock and seed, and new mechanical appliances are constantly being introduced, requiring more knowledge and discrimination in their selection and use.

The particular branch of agriculture upon which I have the honour to address you this evening is that of the production of *meat* and *manure*. We all know that when fattening animals are supplied with a sufficient amount of proper food they increase in weight, a portion of the food being fixed or stored up in the body; that other portions are rejected by the animal in the liquid and solid form, and serve as manure; and that others are expended or lost in the processes of respiration and cutaneous exhalation. Experience also teaches us that some foods

have higher feeding values than others, and it is generally supposed that with a difference in feeding properties there will also be a difference in the value of the manure.

It is the province of agricultural chemistry to determine what proportion of the several constituents of the food consumed will be stored up in the form of meat, and how much will remain as manure, according to the description of animal, and the kind of food employed, and so to provide the means of estimating the value of the respective products of the feeding operation. To this end, it is necessary to determine, by means of careful analysis, the composition of the foods consumed, of animals in the store or lean and in the fat condition, and of the manurial matters voided. Such an undertaking is, however, by no means a light one, and it can only be carried out with any prospect of success by the conjoint aid of experiments on a large scale in the feeding-shed, and of investigations in the laboratory, involving a great amount of analytical labour, and requiring the observance of all the refinements of method which modern science permits.

I propose to bring before you a condensed summary of some of the results which have been obtained in experiments made at different times during the last twenty years, at my farm and laboratory, at Rothamsted, in Hertfordshire. There are, it is true, many points which are not as yet satisfactorily cleared up, and some of these are still under investigation. The figures given in the tables, in most cases, however, represent the results obtained in careful experiments with large numbers of animals of each of the descriptions indicated, and they may be taken as showing what should be the average result obtained in ordinary farm practice, when animals of fair quality are fed liberally for the butcher.

Composition of Oxen, Sheep, and Pigs, in the Store and Fat Condition.

For the purposes of my illustration, I shall assume that an ox or a sheep will increase in weight by about one-half, and that a pig will double its weight during the so-called fattening period. Accordingly, I shall direct your attention to the composition of each of these descriptions of animal when in the lean or store, and also when in the fat condition, after it has increased in the proportion above supposed. I shall then show the average amount of food required to produce 100 lbs. increase in live weight, and also the composition of the food, of the increase, and to some extent of the manure also; and in doing so I shall assume that the animals are liberally supplied with good fattening food; for it should be borne in mind that, as a large amount of the food is expended to maintain the respiration of the animal, the proportion of this expenditure or loss to the amount of saleable increase obtained will be the greater the longer the period required for the production of the increase, and hence it will be the greater if the food be inferior in quality, or stinted in amount.

With these preliminary remarks, I will now direct attention to the tables.

TABLE I.—*Composition, per cent., of Oxen, Sheep, and Pigs, in the Store and in the Fat Condition.*

	Oxen.		Sheep.		Pigs.	
	Store.	Fat.	Store.	Fat.	Store.	Fat.
Nitrogenous substance, ...	18·0	15·0	15·0	12·5	14·0	10·5
Non-nitrogenous substance (fat), .	16·0	30·0	18·0	33·0	22·0	44·0
Mineral matter, ...	5·2	4·0	3·5	3·0	2·8	1·8
Total dry substance, ...	39·2	49·0	36·5	48·5	38·8	56·3
Water, ...	60·8	51·0	63·5	51·5	61·2	43·7
Total, ...	100·0	100·0	100·0	100·0	100·0	100·0

Table I. shows the composition, per cent., of oxen, sheep, and pigs, both in the store and in the fat condition, the constituents given being the nitrogenous substance (lean), the non-nitrogenous substance or fat, the mineral or incombustible matter, the sum of these or total dry substance, and the water.

Taking first the nitrogenous substance, it is seen that in each description of animal there are several per cent. less of it in the fat than in the store condition. Of fat, on the other hand, there is in the case of both the oxen and the sheep nearly, and in that of pigs fully, twice as much in 100 lbs. live weight of the fat, as in the same weight of the store animals. The mineral matter, again, like the nitrogenous substance, is found in less proportion in the fat than in the store animal. Lastly, the proportion of total dry substance is seen to be considerably increased, and that of the water diminished, as the animal passes from the lean to the fat condition.

In fact, the fattening process may be said to consist mainly in the diminution of the proportion of water, and the increase of that of fat. The actual amounts of both the nitrogenous and the mineral matter do, indeed, augment during the fattening process, as will be seen presently, when I come to speak more directly of the composition of the increase itself; but as they do so in so much less proportion than the fat, it results that their proportion in a given live weight becomes less and less, whilst that of the fat increases as the animal matures.

The quality of the meat depends, however, much upon the distribution and the character of the fat deposited as well as upon its amount. Different breeds store up their fat very differently—some more outside upon the carcass, some more around the internal organs, some in more intimate mixture with the nitrogenous or fleshy portion of the meat, and so on. Then, again, complaints are sometimes heard of the fat, particularly of pork, boiling away. Such faulty deposition is generally attributable to the character of the food, and is found to result when too much oily matter is given, or when pigs are fed freely with roots or other succulent food.

Proportion of Parts, in Animals of different Descriptions, and in different Conditions of Maturity.

Passing from the question of the chemical composition of oxen, sheep, and pigs, it will be desirable, before considering the relation of the increase and manure produced to that of the food consumed, briefly to point out some characteristic differences of structure or relative proportion of certain of their internal organs, as in these will be found the key to the difference in the character and amount of food which the three descriptions of animal respectively require. Table II. illustrates this part of the subject.

TABLE II.—*Relation of Parts in Animals of different Descriptions, and in different Conditions of Maturity.*

	Per Cent.					
	In different Animals.			In Sheep in different Conditions.		
	Oxen.	Sheep.	Pigs.	Store.	Fat.	Very fat
Average of	16	249	59	5	100	45
Stomachs and contents, ...	11·6	7·5	1·3	9·1	7·0	5·6
Intestines and contents, ...	2·7	3·6	6·2	5·3	3·8	2·8
	14·3	11·1	7·5	14·4	10·8	8·4
Internal loose fat, ...	4·6	6·9	1·6	4·5	6·0	7·5
Heart, aorta, lungs, windpipe, liver, gall-bladder and contents, pancreas, spleen, and blood, . .	7·0	7·3	6·6	8·4	7·7	6·5
Other offal parts, ...	13·0	15·0	1·0	17·9	16·1	13·1
Total offal parts, ...	38·9	40·3	16·7	45·2	40·6	35·5
Carcass, ...	59·3	59·2	82·6	53·4	58·7	64·1
Loss by evaporation, &c., ...	1·8	0·5	0·7	1·4	0·7	0·4
Total, ...	100·0	100·0	100·0	100·0	100·0	100·0

It is seen that whilst 100 lbs. live weight of the ox comprises about 11½ lbs. of stomach and contents, that of the sheep contains only 7½, and that of the pig only 1¼ lbs. Of intestines and contents, on the other hand, the ox contains only 2¾, the sheep 3½, and the pig 6¼ per cent. Again, of stomachs and intestines (and their respective contents), taken together, the ox contains about 14¼, sheep about 11, and pigs 7½ per cent. Thus, of the receptacles and first laboratories of the food, the oxen contain by far the largest, and pigs by far the smallest proportion, which would appear to indicate a great difference in the requirement for bulk of food, such, indeed, as we know in reality exists. Oxen require a larger proportion of woody fibre in their food than sheep, and sheep much more than pigs. On the other hand, the food of the pig contains much more starch, or allied digestible matter, than that of the sheep, and

that of sheep more than that of oxen, reckoned in relation to the weight of the animal; and it is known that starch undergoes its primary change (into sugar) almost throughout the length of the intestinal canal. Accordingly, we observe that the pig has a larger proportion of intestines than the sheep, and the sheep more than the ox.

Of the further elaborating, or what may be called the skilled labour organs of the body, and their fluids—the heart, liver, lungs, blood, &c.—the proportion is seen to be nearly the same in the three descriptions of animal.

The proportion of internal or loose fat is greater in the sheep than in the oxen; but it should be observed that a large proportion of the sheep contributing to the average result given in the table were in a more advanced state of fatness than the oxen. The comparatively small proportion of internal fat in the pig is accounted for by the peculiarities of the animal. The proportion of its internal organs is comparatively small, and its speciality is to lay on fat in a greater proportion outside the frame.

The second portion of the table shows the varying proportion of the different parts in one and the same description of animal, according to its degree of maturity. The animals selected for illustration of this point are sheep. Records not given in the table show that, as the animals grew and fattened, the actual amount, per head, of stomachs and contents increased considerably; that the intestines and contents did so in a much less degree; that the internal loose fat was more than trebled; and that the other internal parts, and their fluids, collectively, increased in nearly the same proportion as the stomachs and contents. The general result was, that the total offal parts increased in actual amount from the store to the very fat condition in the proportion of about 1 to $1\frac{3}{4}$; but the total carcass parts augmented from 1 to nearly $2\frac{1}{3}$—much more, therefore, than the total offal parts.

Turning now to the figures in the table, it is seen that the per cent., or proportion in 100 parts, of all the internal organs and parts, excepting the loose fat, diminished very considerably as the animals matured and fattened. Whilst the total offal parts diminished from 45·2 in the store to 40·6 in the fat, and to 35·5 per cent. in the very fat condition, the carcass parts increased from 53·4 in the store, to 58·7 in the fat, and to 64·1 per cent. in the very fat condition. That is to say, the so-called offal parts, which are chiefly composed of the organs of reception, elaboration, and transmission of the food constituents, increase in very much less proportion than those parts which it is the object of the feeder should be produced from the food consumed.

Relation of the Increase, Manure, and Loss by Respiration, to the Food consumed by different Animals.

We now come to the question of the description and amount of food consumed by the different animals to produce a given amount of increase, and to the collateral questions of the relation of the constituents in the increase and in the manure to those in the food consumed.

Table III. shows the amounts of certain foods assumed to be required

for the production of 100 lbs. of increase in live weight—of oxen, sheep, and pigs, respectively. The amounts will, of course, vary, according to the quality of the animal, the stage of its development, the external conditions to which it is subjected, the description and quality of the food, and so on; but the quantities assumed are approximately those which will be required, taking the average of large numbers of animals over the whole period of fattening, and supposing foods of the descriptions indicated, and of good quality, are employed, and that other conditions are moderately favourable.

TABLE III.—*Food, Increase, Manure, &c., of Fattening Animals.*

OXEN.

	250 lbs. Oil-cake, 600 lbs. Clover Chaff, 3500 lbs. Swedes and supply—	Produce 100 lbs. Increase,			100 Total Dry Substance of Food supply—			Amount of each constituent stored up, for 100 of it consumed.
	In Food.	In 100 lbs. Increase.	In Manure.	In Respiration, &c.	In Increase.	In Manure.	In Respiration, &c.	
	lbs.	lbs.	lbs.	lbs.				
Nitrogenous substance, . .	218	9·0	323·0	636	0·8	29·1	57·3	4.1
Non-nitrogenous substance,	808	58·0			5·2			7.2
Mineral matter, ...	83	1·6	81·4	—	0 2	7·4	—	1.9
Total dry substance, .	1109	68·6	404·4	636	6·2	36·5	57·3	

SHEEP.

	250 lbs. Oil-cake, 300 lbs. Clover Chaff, 4000 lbs. Swedes and supply—	Produce 100 lbs. Increase,			100 Total Dry Substance of Food supply—			Amount of each constituent stored up, for 100 of it consumed.
	In Food.	In 100 lbs. Increase.	In Manure.	In Respiration, &c.	In Increase.	In Manure.	In Respiration, &c.	
	lbs.	lbs.	lbs.	lbs.				
Nitrogenous substance, . .	177	7·5	229	548·5	0·8	25·1	60·1	4·2
Non-nitrogenous substance,	671	63·0			7·0			9·4
Mineral matter, ...	64	2·0	62	—	0 2	6·8	—	3·1
Total dry substance, .	912	72·5	291	548·5	8·0	31·9	60·1	

PIGS.

	500 lbs. Barley Meal produce 100 lbs. Increase, and supply—				100 Total Dry Substance of Food supply—			Amount of each constituent stored up, for 100 of it consumed.
	In Food.	In 100 lbs. Increase.	In Manure.	In Respiration, &c.	In Increase.	In Manure.	In Respiration, &c.	
	lbs.	lbs.	lbs.	lbs.				
Nitrogenous substance, .	52	7·0	59·8	276·2	1·7	14·3	65·7	13·5
Non-nitrogenous substance	357	66·0			15·7			18·5
Mineral matter, ...	11	0·8	10·2	—	0·2	2·4	—	7·3
Total dry substance, .	420	73·8	70·0	276 2	17·6	16·7	65 7	

The quantities of the different foods recorded in the table have been adopted after a very careful consideration of the results of numerous experiments on feeding on the large scale; and after the illustrations which have been given of the different proportions of the organs in the different descriptions of animal, it will be seen how consistent are the variations in the quantity and quality of the food recorded as required by the different animals. Thus, to produce the same amount of increase, oxen consume a much larger proportion of hay, containing so much indigestible matter, than sheep; whilst pigs are fattened on a diet as concentrated and containing as little indigestible substance as corn alone. The actual amounts of food assumed to be required for the production of 100 lbs. increase in live weight are—for oxen, 250 lbs. of oil-cake, 600 lbs. of hay-chaff, and 3500 lbs. of Swedes; for sheep, 250 lbs. of oil-cake, 300 lbs. of hay-chaff, and 4000 lbs. of Swedes; and for pigs, 500 lbs. of barley meal.

It will be remembered that, when speaking of the composition of the animals themselves, their constituents were grouped under the heads of nitrogenous substance, non-nitrogenous substance, mineral matter, and total dry substance, and the same classification is, for convenience of comparison, adopted in reference to the composition of the food, increase, and manure, of the different animals as recorded in Table III. As the food of the pig is the most simple, I will direct your attention to the figures relating to it in the first place. These will be found in the lowest division of the table.

The 500 lbs. of barley meal consumed in increasing the weight of the pig from 100 to 200 lbs. contained 420 lbs. of dry substance, and the 100 lbs. increase in live weight produced by it not quite 74 lbs.; about 70 lbs. remain in the manure, and 276 out of the 420 lbs. consumed were expended in respiration, and other exhalations from the body. Nearly two-thirds of the whole dry substance consumed have, therefore, been expended in keeping in working order the living meat and manure-making machine.

Looking to the column showing the composition of the 100 lbs. of increase, it is seen that it contains only 7 lbs. of nitrogenous substance, and 66 lbs., or more than 9 times as much non-nitrogenous substance or fat, whilst the mineral matter does not amount to 1 per cent. The general result is, then, that nearly two-thirds of the fattening increase in live weight were pure fat itself, and only about one-fourteenth of it nitrogenous substance or lean meat.

But to produce the 7 lbs. of nitrogenous substance in increase, 52 lbs. were consumed in food; by far the greater part of the remainder being found in the manure. To produce the 66 lbs. of fat, 357 lbs. of non-nitrogenous substance were consumed; but as it existed in the food almost entirely in the form of starch, and as it requires about 2½ parts of starch to form 1 of fat, it may be said that at least 165 lbs. of the non-nitrogenous substance consumed contributed pretty directly to the formation of the 66 lbs. of fat. Lastly, in reference to the increase: of the 11 lbs.

of mineral matter consumed, only about $\frac{3}{4}$ lb. were stored up in the increase of the animal.

It is observed, then, that a comparatively small proportion of either the nitrogenous substance or the mineral matter of the food, is retained in the increase; the manure, on the other hand, retains a very large proportion of the former, and nearly the whole of the latter.

Of 100 parts of gross dry substance consumed, 1·7 parts of nitrogenous substance, 15·7 of fat, and 0·2 of mineral matter—in all 17·6 parts—are stored up in the increase; 14·3 parts, consisting of highly nitrogenous organic matter, and 2·4 parts of mineral matter, making a total of 16·7 parts, are retained in the manure; and 65·7 parts, consisting chiefly of carbon, hydrogen, and oxygen, are lost by respiration, &c. Or, if we reckon the proportion of each class of constituents consumed which is stored up in the increase, the last column of the table shows that of 100 of nitrogenous substance consumed, 13·5 parts; of 100 non-nitrogenous substance consumed, 18·5 parts; and of 100 mineral matter consumed, 7·3 parts are retained in the increase.

It will not be necessary to follow so closely the figures in the table relating to the sheep and oxen. It will suffice to direct attention to the chief differences of result obtained with the three descriptions of animal.

Whilst the pig required only 420 lbs., the sheep required 912 lbs., and the oxen 1109 lbs. of dry substance in food to produce 100 lbs. increase in live weight. In other words, the sheep consumed more than twice as much, and the oxen more than two and a half times as much, to produce a given amount of increase, as the pig. But the food of the pig was of a much higher character than that of the other animals. Whilst it consisted entirely of highly elaborated grain, closely resembling human food, the food of the other animals contained a large amount both of woody fibre and of crude succulent roots; the dietary of the ox containing the largest proportion of hay, with its high percentage of indigestible woody matter.

Turning to the columns giving the composition of 100 parts of the increase, they show that whilst that of the pig contained 73·8 parts of dry substance, that of the sheep contained rather less, and that of the oxen rather less still. The proportion of fat also was greater in the increase of the pig than in that of sheep, and greater in that of the sheep than in that of the oxen. The contrary was, however, the case with the proportion of nitrogenous substance, which was the greatest (9 per cent.) in the increase of the oxen, less (7·5 per cent.) in that of sheep, and less still (7 per cent.) in that of pigs. It will be observed, too, that the percentage of mineral matter in the increase of the ox and sheep is considerably higher than in that of the pig; and it is even rather higher in the case of sheep than oxen. Independently of any essential differences of structure in the different animals, this result is partly due to the fact that sheep and oxen, especially sheep, develope bony structure during the fattening process more than pigs. It is true that both

sheep and pigs are, compared with oxen, fattened at an earlier stage of their development; but not only is the pig more naturally disposed to fatten instead of grow in frame very early in his career, if only liberally supplied with proper food, but the practice of feeders, to meet the demands of the market, is to encourage growth as well as fattening much more in the case of sheep than of pigs.

Comparing the constituents stored up in increase for a given amount of dry substance of food consumed in each case, the table shows that for 100 gross dry substance of food, the oxen and sheep stored up less than 1 per cent., and the pigs more than twice as much of nitrogenous substance; that of fat the oxen stored up only 5·2, the sheep 7, and the pigs 15·7 parts.

Or, looking at the subject from another point of view, the last column of the table shows that for 100 nitrogenous substance of food consumed, the oxen and sheep stored up little more than 4, but the pig about 13·5 parts; that for 100 non-nitrogenous substance in food, the oxen yielded 7·2, the sheep 9·4, and the pigs 18·5 parts of fat in increase; and that for 100 mineral matter consumed, the oxen stored up 1·9, the sheep 3·1, and the pigs 7·3 parts.

That a very much larger proportion of the constituents of the food of the pig than of that of oxen and sheep should be stored up as increase is, however, only what we should expect, when we consider that the former consists of matured grain, and the latter chiefly of comparatively immatured vegetable produce, containing a large proportion of indigestible and woody matter, and also a larger amount of nitrogenous and mineral matter in proportion to its digestible and available non-nitrogenous constituents.

But whilst the pig, with his much higher character of food, gave so much more increase than the sheep for a given amount consumed, and the sheep more than the ox, the ox returned as manure 36·5 per cent. of the dry substance he consumed, the sheep not quite 32, and the pig only 16·7 per cent. The proportion of the consumed matter that was lost by respiration was, on the other hand, rather the lowest with the ox, namely, 57·3 per cent.; whilst with the sheep it was 60·1, and with the pig it was 65·7 per cent. Or, reckoned in proportion to a given amount of increase produced, the oxen gave, for 100 lbs. of increase in live weight, 404 lbs., the sheep 291, and the pigs only 70 lbs. of dry substance in manure; and for the same amount of increase, the oxen lost of dry substance, by respiration, &c., 636 lbs., the sheep 548·5 lbs., and the pigs 276·2 lbs.

There is another point from which it is desirable to view the difference of the result obtained with the different descriptions of animal. This is illustrated by the figures given in Table IV., which shows for oxen, sheep, and pigs, respectively, the amounts of increase yielded, and of dry substance consumed in food, voided as manure, and lost by respiration, per 100 lbs. live weight per week.

TABLE IV.—*Amount of Increase yielded, and of Dry Substance consumed in Food, recovered as Manure, and lost by Respiration, &c., per 100 lbs. live weight, per week.*

	Per 100 lbs. live Weight, per Week.			
	Increase yielded.	Dry Substance.		
		Consumed in Food.	Recovered as Manure.	Lost by Respiration, &c.
	lbs.	lbs.	lbs.	lbs.
Oxen, ...	1·13	12·5	4·56	7·16
Sheep, ...	1·76	16·0	5·10	9·62
Pigs, ...	6·43	27·0	4·51	17·74

The first column of this table shows that whilst the pig increases from 6 to 6½ per cent. of its weight per week, the sheep increases only 1¾, and the ox little more than 1 per cent. No wonder, then (to say nothing of the difference in the character of the food), that the oxen and sheep, requiring so much longer time to add a given proportion to the weight of their bodies, should consume so much more food, void so much more as manure, and expend so much more in respiration, for a given amount of increase produced, as we have seen they do.

The other columns of the table show, however, that neither the amount of dry substance of food consumed, nor the amount lost by respiration, by a given weight of animal within a given time, is in excess with the pig in anything like the proportion that its increase exceeds that of the other animals. In other words, the much higher character of the food of the pig shows itself in the much greater rapidity, and the much greater proportion of its conversion into meat—the most valuable product of the feeding operation.

Lastly in regard to the results in this table, it is remarkable that, whilst, for a given weight of the body within a given time, the amounts of increase yielded, and of dry substance consumed in food, and lost by respiration, are so very different for the different animals, the amounts of dry substance voided in excrements are almost identical. I shall show further on that the limit of consumption is much regulated by the amount of non-nitrogenous substance contained in the food; and hence it would appear that the respiratory function had much to do with determining the amount of food consumed. It would also seem, from the equality of amount of dry substance voided by a given live weight of the different descriptions of animal within a given time, that the limit of consumption had also some connexion with the amount of transformed and effete matter that the system could pass; and hence that the surplus available for increase was fixed by the necessary proportion of digestible and assimilable to effete matter in the appropriate food of the respective animals.

To sum up the points thus far illustrated, it may be said—

1. That during the fattening process the proportion, in a given weight

of the body, of water, mineral matter, and nitrogenous compounds decreases, whilst that of the fat very considerably increases.

2. That the carcass parts, or saleable meat, increase more rapidly than the internal parts or offal.

3. That the amount of dry substance of food required to produce a given weight of increase is larger with the ox than with the sheep, and larger with the sheep than with the pig.

4. That the dry substance of the food of the ox contains a larger proportion of indigestible matter than that of sheep, and that of sheep more than that of pigs.

5. That oxen require from 5 to 6, and sheep from 3 to 4 times as much time to add a given proportion to the weight of their bodies as pigs.

6. That the greater portion of the nitrogenous and mineral matters of the food is recovered in the manure; and that the greater part of the non-nitrogenous substance is lost by respiration and other exhalations—a much smaller proportion being retained in the increase, or voided in the manure.

7. That for a given amount of increase produced, oxen void considerably more substance as manure, and expend more in respiration, &c., than sheep, and sheep very much more than pigs.

8. That for a given weight of dry substance consumed, oxen void more as manure than sheep, and sheep much more than pigs; but oxen respire rather less than sheep, and sheep rather less than pigs.

9. That in proportion to a given weight of animal, within a given time, oxen both consume and respire less dry substance of food than sheep, and sheep very much less than pigs; but they void almost identical amounts of dry substance as manure.

Comparative Feeding Value of different Foods, according to their Composition.

Thus far I have endeavoured to indicate the characteristic points of distinction between the food of the ox, the sheep, and the pig, and to show in what respects its constituents are differently disposed of by the different animals; and for the purposes of my illustration, I have supposed the animals to be fed on such foods as are recognised as appropriate to them, and in such proportion and amount as experience justifies. I now propose to say a few words on the relative feeding properties of different foods, according to their composition.

Leaving out of view, just now, the incombustible or mineral constituents, it will be convenient, as before, to consider the other constituents of food to be grouped under the heads of nitrogenous and non-nitrogenous substances.

Among the nitrogenous substances, the most important of those which enter into our stock foods are albumen, casein, legumin, and gluten; and chemists and physiologists are accustomed to speak of these—the nitrogenous compounds—as the flesh-forming substances.

The non-nitrogenous constituents of our stock foods are starch, sugar, gum, pectin, oil, and cellulose, or woody fibre in different conditions of digestibility or induration. The non-nitrogenous compounds are spoken of as the respiratory or heat-producing, and fat-forming substances.

Now, writers on agricultural chemistry and physiology have generally assumed that it is chiefly the proportion of the nitrogenous or so-called flesh-forming substances contained in them, which determines the comparative value, for feeding purposes, of different foods.

The coloured diagram before you will enable you to judge whether or not this supposition is justified by the practical experience of feeding. This diagram has been constructed by the animals themselves. They know nothing about nitrogenous or non-nitrogenous constituents, digestible or indigestible cellulose, and so on; but they are gifted with an unerring instinct, which enables them not only to distinguish between substances which are and are not food, but also to select from a variety of food stuffs those which are most suitable for the requirements of the system, and so to indicate to us the proper amounts and proportions of the different constituents.

In the experiments to which the diagram refers, as well as in many others, the plan has been to select foods containing very different proportions of nitrogenous and non-nitrogenous compounds; in fact, some containing two or three times as much nitrogen as others. We have then given to one set of animals a small fixed amount daily, of food containing a low percentage of nitrogen, and allowed them to take as much as they chose of another food, different in composition in this respect. To another set we have given a limited amount of food, rich in nitrogenous compounds, and allowed the animals to take, *ad libitum*, of a different description of food, and so on. In this way they have been enabled to fix for themselves the limit of their consumption of nitrogenous and non-nitrogenous constituents, respectively, according to their wants.

The diagram shows the results of such experiments with pigs; and the foods employed were Indian corn meal, barley meal, bean meal, lentil meal, bran, and dried cod-fish, used alone, or in combination, as the case might be. Black being taken to represent nitrogenous substance, red non-nitrogenous substance, and green total dry organic matter (nitrogenous and non-nitrogenous together), the diagram is constructed as follows:—The smallest quantity of nitrogenous, or non-nitrogenous, or total organic matter consumed in any one experiment is reckoned as 100; and the several lines above the base line, which is marked 100, indicate larger amounts, corresponding to the figures given at the side of the diagram.

The upper portion shows the relative amounts of each constituent consumed in each experiment per 100 lbs. live weight per week; that is to say, by a given weight of animal within a given time. A glance shows you that the height to which the colours representing the non-nitrogenous, or the total organic substance reach is very much more uni-

form than that indicating the consumption of nitrogenous substance. In fact, it is perfectly clear that the animals were guided in the amount of food which they consumed by the amount of non-nitrogenous, and not by that of the nitrogenous constituents which it supplied.

But, according to current theories, the amount of nitrogenous substance ought at least to determine the amount of increase produced. The lower portion of the diagram shows what the animals have to say on this point. The arrangement is the same as before; but the results show, not how much of each class of constituents was consumed by a given weight of animal within a given time, but how much was consumed to produce a given weight (100 lbs.) of increase.

Here again we see that the amount of either non-nitrogenous or total organic substance consumed varied comparatively little, whilst that of the nitrogenous substance consumed for the production of a given amount of increase varied from 100 to over 300 parts.

It is obvious, therefore, that both the amount of food consumed by a given weight of animal within a given time, and that required to produce a given weight of increase, were determined by the amount of available non-nitrogenous substance which the food supplied. The quantities required would, doubtless, have varied within even narrower limits, had all the foods contained equal proportions of indigestible woody matter.

It may be observed that it is doubtful whether pigs are able to digest cellulose, or woody fibre, at all; but there is no doubt, as the investigations of ourselves and others on the point sufficiently prove, that oxen and sheep are able to digest a considerable portion of such matter, when it is not in too indurated a condition.

It will, of course, be understood, that a certain amount and proportion of nitrogenous substance is essential in the food of animals; and if I were asked to state in general terms what was the approximate proportion of the nitrogenous to the digestible non-nitrogenous substances, below which they should not exist in the food of our stock, I should say (though with reservations), about such as we find them in the cereal grains; and since few of our stock foods are below, and many above, this in their proportion of nitrogenous substance, it results that we are more likely to give an excess than a deficiency of such constituents, so far as the requirements of the animal are concerned. The value of the manure depends, however, very much on the amount of the nitrogen which the food contains; but to this point I shall recur after directing attention to a few more points in connexion with the comparative values of different foods as such.

Some years ago we published the results of some experiments on the equivalency of starch and sugar in food, pigs being the subject of the trial. Several lots having each a fixed and limited quantity of lentil-meal and bran allowed, one was permitted to take as much starch, another as much sugar, and another as much of the mixture of the two as they chose; whilst in another experiment the animals were allowed to select at discretion from lentils, bran, sugar, or starch, each placed separately within their reach. The result was, that sugar and starch

were found to have, weight for weight, practically the same value as constituents of food.

These results would, *à priori*, lead to an answer in the negative to the much agitated question, whether there is any advantage in malting barley for feeding purposes. The chief effect of the malting process is to convert starch into sugar—not, it is true, sugar of exactly the same description as that used in our experiments; but there is good reason for supposing that malt sugar would have a lower value than cane sugar as a food constituent; and direct experiments, made many years ago at Rothamsted, have shown that a given amount of malt, mixed with other food, gave less rather than more increase than the amount of barley from which it was produced. It is obvious, too, that as the conversion of barley into malt is a manufacturing process, attended with considerable cost, as well as actual loss of substance, the remission of the duty on malt employed for feeding purposes would not be likely to be of benefit to the farmer, unless either a given amount of malt sugar proved to be of considerably higher feeding value than the starch from which it was produced, or the other constituents were rendered more digestible and assimilable by the process.

This leads me, before leaving the subject of foods, to make a few remarks on some other manufactured foods for stock. Many complaints are made, and justly made, of the adulteration of oil-cakes; and it is sometimes asserted that cheaper and better foods than the average of cakes now in use could be manufactured with advantage both to the maker and to the feeder. Linseed and other cakes are themselves, in one sense, manufactured foods. But the object of the manufacturer is not the production of cake, but of oil. If the farmer did not use the cake at all, it would still be made, and the oil would be sold for a higher price. As it is, the manufacturer makes the cake as a bye-product, and the price he gets for it enables him to sell his oil so much the cheaper.

But if manufactories were set up for the special purpose of preparing foods for stock, the whole cost of the undertakings must be charged upon the food. Lentils, beans, peas, Indian meal, barley meal, linseed, and other good staple foods must be used; and although it might be possible so to combine foods together that a given weight of the mixture would possess a somewhat higher feeding value than the component parts used singly, there is every reason to suppose that the increased cost would more than counterbalance any slight benefit that could be derived in that way. Nor do I anticipate that the progress of science will aid us much in this direction. Condimental foods have been tried, and found wanting; and I have little doubt that a similar result will attend the manufacture and use of simpler food mixtures. Our hopes as feeders must be in increased and cheap supplies of ordinary cattle foods of a good quality, rather than in submitting those we have to costly processes of manufacture.

The results arrived at in regard to this portion of the subject may be briefly summed up as follows:—

1. The comparative feeding value of our current stock foods depends more upon the proportion of the digestible non-nitrogenous substances they contain than upon their richness in nitrogenous compounds; but the richer the food in nitrogen, the more valuable will be the manure.

2. Of the non-nitrogenous constituents of food, starch and cane sugar have, weight for weight, nearly equal feeding values; malt sugar has probably rather a lower value than either cane sugar or starch; digestible cellulose, in moderate proportion, has, for ruminant animals, probably nearly the same value as starch; and fat or oil have probably about two and a half times the value of starch for the purposes of respiration, or the storing up of fat in the body.

3. Some advantage results, in a feeding point of view, from the judicious mixture of a variety of ordinary stock foods; but the benefit to be derived in this way is not such as to compensate for the extra cost of a special manufacturing process to attain it.

Connexion between the Value of the Manure and the Composition of the Food consumed.

The next and last branch of the subject relates to the comparative value of the different constituents in the liquid and solid voidings of the animals, and to the connexion between the value of the manure and the composition of the food from which it is produced.

I have already pointed out that the greater portion of the carbon, hydrogen, and oxygen of the food either passes into the increase or off in respiration, and that comparatively little of any of them is recovered in manure. By far the larger portion of the nitrogen, and nearly the whole of the mineral matter consumed are, however, so recovered.

To show the economic connexion between the feeding of stock for the production of meat and manure, and the growth of corn, I propose to adduce a few results obtained in experiments on the growth of wheat by different manures. In the experiments in question, wheat has been grown for twenty successive seasons on the same land.

In Table V. are given the average annual produce of corn and straw, and the estimated yield of carbon, per acre, over the last twelve years, respectively without manure, with mineral manure alone, with mineral and nitrogenous manure (ammonia salts), and with farm-yard manure.

TABLE V.—*Average Annual Produce of Wheat, and estimated Yield of Carbon, per Acre, over 12 Years.*

Manures per Acre per Annum.	Average Annual Produce per Acre.			
	Dressed Corn.	Total Corn.	Straw.	Carbon.
	Bushels.	lbs.	lbs.	lbs.
Unmanured, ...	15½	964	1662	1062
Mineral manure alone, . .	18½	1157	1897	1234
Mineral manure and 400lbs. ammonia salts, ...	36½	2275	4212	2625
14 tons farm-yard manure, .	35½	2232	3869	2467

Where the farm-yard manure was employed, more carbon, as well as more of every other constituent, was annually applied in manure than removed in the crop. In the other cases no carbon whatever was supplied in the manure; and yet it will be observed that where the mineral manure and ammonia salts were employed (the latter containing a large amount of nitrogen), the yield of carbon was greater than where a large amount of that substance was supplied by means of farm-yard manure. This carbon must have been derived from the atmosphere. In several experiments in this field last year, from 1⅓ to 1¾ tons of carbon per acre were removed in the crop, without any being supplied in manure; but in these cases large quantities of nitrogen were supplied.

The quantity of carbonic acid required to yield 1½ tons of carbon to the crop is about as much as would be given off into the atmosphere in a year by twenty-two individuals of a mixed population of both sexes and all ages, and it will be seen that it is under the influence of ammoniacal or nitrogenous manure that this large amount of carbon has been fixed in the plant from the carbonic acid of the atmosphere.

The results given in Table III. showed how small was the proportion of the nitrogen consumed by an animal in its food that was stored up in its increase, and sent to market as meat. If there were none of the nitrogen of the food lost in the various exhalations from the body the whole of that not stored up in increase would be found in the manure. But the investigations of ourselves and others show that a certain portion of the nitrogen is so lost. Our own experiments to determine the limit of this loss, and the circumstances under which it is greater or less, were commenced as far back as 1847, and have been resumed occasionally from that time to the present; and during the last few years we have collected a great deal of experimental data on the subject; but as the whole of the analytical work is not yet concluded, I do not feel that I am in a position to give any numerical statement of the results obtained. It may, however, be stated as beyond doubt, that by far the larger portion of the nitrogen consumed in food is rejected by the animals in their liquid and solid voidings; and that the higher the proportion of nitrogen in the food, the richer will be the excrements in that important constituent of manures.

Some years ago I published a Table, showing the estimated value of the manure obtained from the consumption of one ton of different articles of food used in ordinary farm practice. The valuation was founded upon a knowledge of the average composition of the different descriptions of food, and upon information, arrived at in the course of the experiments just referred to, as to the probable average amount of the constituents of food valuable for manure which will be obtained in the solid and liquid excrements of the animals.

Stating the results of these valuations in very general terms, it may be said that the estimated value of the manure from 1 ton of oil-cake was considerably more than that from the same quantity of linseed, lentils, tares, beans, or peas; from two to three times as much as that from 1 ton of oats, wheat, Indian corn, barley, or hay; from seven to ten

times as much as from the same weight of oat, wheat, or barley straw; and about twenty times as much as from 1 ton of roots.

It is obvious, therefore, that in the selection of purchased foods for stock, it is very important to consider their manuring as well as their feeding value. One illustration on this point will suffice. A ton of locust beans will certainly not yield nitrogen in the manure of the animals consuming it equal to more than, if to as much as, $\frac{1}{4}$ cwt., or 28 lbs., of ammonia; but a ton of rape-cake will yield 1 cwt., or four times as much. If, therefore, we take the ammonia in the manure at 7*d.* per lb., the amount of it obtained from the consumption of a ton of locust beans will be worth only 16*s.* 4*d.*; whilst that from the ton of rape-cake will be £3 5*s.* 4*d.*

There is, in fact, far greater difference in the manuring than in the feeding value of most of the ordinary stock foods in the market.

In illustrating the comparative value of the manure obtained from different foods, by reference merely to the amounts of nitrogen or ammonia-yielding matter which they supply, it will not be understood that I in any way ignore or underrate the value of the mineral constituents associated with the nitrogenous matter in the excrements. But, inasmuch as the amount of mineral constituents voided is generally in excess of that required for the due effect as manure of the nitrogen with which they are accompanied, it results that the amount of the nitrogen or ammonia-yielding matter is practically the best index to the value of the manure.

Appropriateness of Animal Food in the Diet of Man.

It will be obvious that the importance of the subject which I have brought before you this evening rests upon the assumption that animal food is an important element in the diet of man. There are, indeed, some who maintain that a purely vegetable diet would be more suitable and natural than the mixed vegetable and animal one so generally preferred. If their view were adopted, we need no longer trouble ourselves about the connexion between the food, the increase, and the manure of fattening oxen, sheep, and pigs. There are, however, various circumstances, economical and physiological, pointing to the appropriateness of admitting a certain proportion of animal food into the diet of man. To one or two of these I will briefly refer.

Walking is for man undoubtedly a very natural means of progression. Still, it is often very advantageous to ride, and so to employ the legs of a quadruped instead of our own. In eating meat we may be said to employ the stomachs of other animals to do that which we could not so well do with our own. As a few ounces of gold are separated from many tons of rock by the combined aid of mechanical and chemical processes, so the animals feeding upon crude, and often to us indigestible, vegetable matter, eliminate from it, and store up in their bodies some of its constituents in a form at once much more concentrated than that in which they consumed them, and much more easily appropriated by the human economy. A given amount of nitrogenous compounds in the

form of meat is undoubtedly more easily digested and assimilated by man than if the same amount were supplied in the form of beans. Then, again, the animals convert starch, sugar, &c. (and probably some of them cellulose, which we could not digest at all), into fat, which has twice and a half the respiratory and fat-storing capacity of the substances from which they produce it. It is, doubtless, true that man can produce fat, and keep up his respiratory function from starch and sugar; but it can hardly be doubted that there is some economy to his system in having a portion of fat supplied to him ready made.

Apart from the strong testimony of common experience on the subject, there is evidence in the comparative structure of man that he is adapted for a concentrated form of food. One illustration, in passing, may be adduced on this point. Table VI. shows the proportion of the stomach, by weight, in a given live weight of oxen, sheep, pigs, and man:—

TABLE VI.—*Proportion of Stomach in different Animals.*

Stomach in 100 lbs. live weight:—

Oxen, ...	51 ounces.	Sheep, ...	39 ounces.
Pigs, ...	14 „	Man, ...	6 „

Relative weight does not, of course, necessarily represent with numerical exactness relative capacity or size. But there is little doubt that there is a gradation in the capacity of the stomach relatively to a given weight of the body in the animals enumerated, in the order, and to a great extent in the degree indicated by the figures given in the Table. Admitting this to be the case, we have seen that the sheep, with its less proportion of stomach than the ox, takes a somewhat more concentrated food; and that the pig, with its much less proportion of stomach than the sheep, requires a much more concentrated food than the latter. May we not conclude that man in his turn, with his less proportion of stomach than the pig, will also appropriately take a more concentrated food than his useful friend?

The food of man is, indeed, very closely allied, in a chemical point of view, to that of the pig. The staple of the food of both the fattening pig, and man, is cereal grain. The pig, it is true, consumes the husk as well as the farinal portion, whilst man does not; but we know that this proportion of indigestible woody matter is very nearly the limit of that which is appropriate for the fattening pig, and that on the addition of a small quantity of bran the proportion of increase diminishes, and that of the dry substance of the food voided as excrement increases. The only other essential difference is, that the pig takes, as a rule, the whole of his nitrogenous compounds in the form of vegetable products, and a much larger proportion of starch, and other non-nitrogenous compounds, more bulky in relation to their respiratory and fat-forming capacity than fat itself. Not, indeed, that the pig is at all unapt or unwilling to adopt even still more closely the diet of man; for he will take animal flesh and fat when he can get them, and, what is more, he likes them better cooked than raw.

Were it not, then, that man separates the husk from the flour, and that he gets lower animals to eliminate in an easily digestible form a portion of his nitrogenous aliment, from foods which he could not himself readily digest, and that he gets them also to provide him with a portion of his respiratory and fat-storing food in the concentrated form of fat itself, we could hardly account for the less proportion to a given weight of the body of the stomach—the receptacle and first laboratory of the food—in his case than in that of the pig. We know, indeed, that in the cases where man is reduced to depend for nearly the whole of the non-nitrogenous constituents of his food upon starch, in the form of potatoes or rice, there is a disposition to an enlargement of the abdominal organs, and to a diminution in physical and mental energy.

To conclude on this point, there can be no doubt whatever that the food of the labouring man is improved when he can add to his bread a portion of fat bacon, or butter, or fat in some other form, and it is better still if he can substitute or supplement a little butcher's meat. Indeed, that which common experience recognises as high quality of diet is, within certain limits, high proportion of animal to vegetable food, and with it high proportion of fat to starch and other non-nitrogenous compounds.

But not only do the animals which we fatten for our own food convert vegetable produce which we either could not digest at all, or could do much less easily than they, into concentrated and easily digestible and assimilable material for our use, but in doing this they supply carbonic acid to the atmosphere, and return the most important manurial constituents of their food in their excrements, thus providing, to both the soil and the atmosphere, from crude vegetable products, that which is necessary for the luxuriant growth of cereal grain, and other vegetable produce suited for the direct use as food for man.

Were it not for such compensations, by the increase of man and other animals upon the surface of the earth (if it could take place at all), by the enormous quantities of carbonic acid evolved into the atmosphere from the combustion of coal and from other sources, and by the gradual destruction of forests, which are the chief natural agents for restoring the balance, the purity of the atmosphere would become affected. But the grasses, which supply so large a proportion of the food of beasts, and the cereals and the other plants of the same great family, which supply food to man in almost every climate, serve to re-use the carbon given into the atmosphere in the form of carbonic acid. It may seem at first sight strange that the humble grasses, and the corn crops, reaching only a few feet from the surface of the ground, should be able to take up more carbonic acid, and evolve more oxygen, over an acre of land than an acre covered with forest trees. Still, there can be little doubt that more carbon is fixed in an acre of luxuriant wheat than over the same area of woodland; and there can be as little that an acre of sugar cane would fix more than an equal area of the most luxuriant tropical forest.

Conclusion.

With a few general remarks of a practical nature, I will conclude my discourse. The great change which has taken place in the practice of feeding stock in modern times has consisted in bringing the animals much earlier to maturity, by means of careful breeding, and more liberal feeding. Scales and weights were seldom used in agricultural experiments until comparatively recently; but there are some few records of the results of feeding as practised at the latter end of the last century, which will serve us in instituting a comparison between the results then obtained and those which are possible, or even common, at the present day.

In 1794 the Duke of Bedford made some experiments to determine the comparative feeding qualities of South Down, Leicester, Worcester, and Wiltshire sheep. Twenty of each were selected and weighed on November 19, 1794. To each lot were allotted 16 acres of pasture, and in the winter some turnips were thrown upon the pasture, and a small quantity of hay was also provided. On February 16, 1796, after a period of sixty-five weeks of feeding, the experiment was concluded, and the sheep sent to market.

Over the whole period the sheep gave an average increase of between 40 and 50 lbs. per head; and as their original weight was nearly 100 lbs. per head, they increased nearly 50 per cent. from the store or lean to the fat condition, which is the same proportion as that assumed in the illustrations to which Table III. refers.

Some years ago, I tried a set of experiments upon the comparative fattening qualities of South Downs, Hampshire Downs, Cotswolds, Leicesters, and cross-bred wethers, and cross-bred ewes, each lot consisting of between 40 and 50 sheep. They were put up in November, when their weights were very nearly the same as those of the Duke of Bedford's sheep; and when fat, they had increased in about the same degree, namely, to an average of about 150 lbs. each. The Duke of Bedford's sheep were about 65 weeks in adding 50 lbs. to their weight, and mine in some cases 20, and in others a little more, or about one-third the time. It is somewhat singular that in May—the period at which my sheep were consumed as mutton—the Duke of Bedford's were weighed for the first time since the commencement of the experiment, and were found to have increased only about 6 lbs. per head.

The difference of result in these two cases was almost entirely due to the difference in the mode of feeding. Formerly, sheep received perhaps a few turnips on their pasture, and but little dry food, and that not of high feeding quality; and the consequence was, that during the colder months of the year they either lost weight or increased but little. Now they have a liberal allowance of good food, and are frequently protected from the inclemency of the weather. In my own experiments, just referred to, the sheep were allowed from ¾ lb. to 1 lb. of oil-cake per head per day, according to their weight, about the same amount of clover chaff, and as many Swedes as they chose to eat, and they gave an average increase of nearly 2 per cent. upon their weight per week.

There is no doubt that in rapidly fattening stock at an early age, quality of meat is to some extent sacrificed to quantity. But it is only by means of the modern system of liberal feeding and early maturity that meat can be brought within the reach of the masses of the population. The farmer, too, must look to that system which will pay him the best; and the difference between the price which the consumer will give for a pound of four-year-old and one-year-old mutton will, only under very exceptional circumstances of locality, remunerate him for the extra cost of production.

In conclusion, I have only now to thank you for the very kind attention with which you have followed me through what I fear may be thought by many of you somewhat tedious detail. The subject of the chemistry of feeding is, however, essentially an intricate one; and I think you will have learnt from my lecture, if you did not know it before, that there still remains much to be determined by careful investigation respecting it. But if I have in any degree succeeded in indicating the proper points of view from which this, at once practical and scientific question should be studied, and in impressing upon your minds some prominent and important facts regarding it, so as to lead to improvement in practice by a better knowledge of principle, or to further inquiry, and so to an extension of our knowledge, I shall feel that the objects of my desire and endeavour in addressing you have been fully attained.

The Chairman said he was sure they all felt very much obliged to Mr. Lawes for the very clear and satisfactory account he had given them of the present condition of science with regard to the feeding of stock and the production of manure. The paper which Mr. Lawes had read was based upon investigations which had very peculiar merit. They had not been undertaken as matters of mere scientific curiosity in the laboratory; they were not merely the paste-and-scissors compilations which a great deal of the literature of agricultural science unfortunately consisted of at the present day; but they were the well reasoned and carefully ascertained results of labour, and he must say honest investigation, conducted under circumstances unusually favourable, and with a degree of cautious care which was the most valuable part of the career by which Mr. Lawes had earned the well-merited and general repute which he had acquired. Some years ago he had the pleasure of visiting Mr. Lawes' establishment, and of seeing the plans of investigation which were there put in operation for the benefit of agricultural science; and he did venture to say—and he had some experience of chemical investigations—that there did not exist in Europe so worthy a national monument of agricultural progress as the establishment which, under Mr. Lawes' care, and by his conscientious industry, had been carried on in the neighbourhood of London.

Dr. Cameron rose to express his opinion of the value of the paper which they had heard read, and to bear testimony to the great services which Mr. Lawes had rendered to agricultural science, and to agriculture generally. He was a scientific and practical man in his own person, and he knew of no one who was so capable as Mr. Lawes of clearing up the obscure things in agricultural science. The obscurity of scientific agriculture had been to a great extent cleared away by Mr. Lawes' paper, and many of his contributions to the philosophical transactions of the Royal Society had been of the greatest importance. He thought, with the Chairman, that the great feature of Mr. Lawes' career was the remarkable accuracy in all his experiments. There was no doubt

in the world as to the accuracy of his facts, nor was there any doubt as to the accuracy of his conclusions. With regard to the proportion of fat and flesh-forming substances in various kinds of food, he might observe that they had recently heard of Monte Video beef, which on analysis was only found to possess 5 per cent. of fat; the rest was fibre and albumen, the nutritive properties of which were doubtful. They had all been inclined to believe that the food of the people of this country was wanting in flesh-forming materials; that there was too much starch-forming matter in the food of the Irish peasantry. Now, Mr. Lawes had clearly proved by several investigations that in consuming vegetable food, such as bread, they used a larger proportion of nitrogenous matter than if they consumed all flesh food. They found no fat at all in the potato; but when the poor got a chance of anything else they selected fat bacon, dripping, or some thing that had fat in it, and did not go to stringy beef like that of Monte Video. Having entered somewhat into the details of the question, Dr. Cameron concluded by expressing his satisfaction at the paper which they had heard read.

Mr. Baldwin, of Glasnevin, said that, with the view of promoting discussion and eliciting more information from Mr. Lawes, he wished to draw attention to a few matters which struck him as Mr. Lawes was explaining his elaborate tables. In one of these tables Mr. Lawes appeared to him to assume that the instinct of animals may be made the basis on which to judge of the kinds and quantities of plastic constituents which they require. Is this notion a mere hypothesis, or a deduction from actual experiments? In another table we are presented with facts which, if quite reliable, appear to me well calculated to enable us to judge of the relative profitableness of fattening cattle, sheep, and pigs. Taking the cattle, and assuming that 65 per cent. of the increased live weight was marketable beef, and valuing this at the price at which I saw beef sold this morning in the Dublin cattle market, and allowing (what Mr. Lawes calculated in another paper of his) that the value of the manure from a ton of turnips was worth 4*s*., and from a ton of cake upwards of £4, it appears to me this table assigns a high feeding value to turnips. I should like to have the opinion of some of the experienced agriculturists now present on this point, as well as on the facts which this table presented as to the relative merits of cattle, sheep, and pigs as producers of meat and profit. Again, Mr. Lawes, if I followed him rightly, suggested that the ratio between the nitrogenized and non-nitrogenized constituents in cereals may be regarded as a fair criterion of what it should be in cattle food. I would have rather thought the ratio in grass, which is the natural food of cattle and sheep, may be rather better for those animals; and would like the opinion of Mr. Lawes on this point. If my memory serves me right, the nitrogenized is to the non-nitrogenized constituents in grain as 1 to 6; and in grass it is less. Adverting to Dr. Cameron's views on "jerked" beef, he thought his reasoning fallacious. We are told this beef contains too little carbonaceous and too much (?) nitrogenized matter. Now, it is notorious that the diet of the Irish labourer is deficient in nitrogenized matter. His potatoes contain too little nitrogenized in proportion to their carbonaceous matter; and I see no good reason why a cheap and concentrated nitrogenized substance like South American beef could not be united with his potatoes. He had learned from a South American gentleman who had been recently in Ireland that this beef forms the staple article in the diet of large numbers of our fellow-men; and through him I have got information on its cooking, &c., which enables me to say that the mode of using it is not well understood in this country. Furthermore, I beg to remind Dr. Cameron that he appears to forget that the requirements of a working animal are different from those of a fattening animal. We keep the latter as quiet, and cause as little waste of their tissues, as possible. In working animals—the horse, man, &c.—the tissues are necessarily wasted, and to supply this waste, we must supply food more largely than for fattening—a food like jerked beef, containing a large quantity of nitrogenized matter. In conclusion, Mr. Baldwin begged to add his testimony to the valuable services rendered to the cause of British agriculture by Mr. Lawes. Whoever reads the history of agriculture for the last twenty years will find prominently on its pages the name of J. B. Lawes. There is not, perhaps, from any one pen in the literature of any science during that period as great or valuable a number of

papers as Mr. Lawes has contributed to the literature of British agriculture in the pages of the journal of that great institution, the Royal Agricultural Society of England.

Mr. Waller said he knew a manure in the county Wexford that had neither phosphates nor ammonia. He had tried it on the principle propounded by Liebig, that if they applied inorganic food to plants they enabled those plants to extract organic food from the atmosphere. The manure he referred to was limestone, containing about 6 per cent. of lime, between 11 and 12 per cent. of silex; it contained sulphur, soda, and a trace of magnesia and iron, with about 2 per cent of potash.

Some further conversation having ensued, Mr. Lawes made a few observations in reply.

Mr. Borthwick, J. P., said it should not be forgotten that Mr. Lawes had given a valuable silver cup as a prize for the encouragement of the growth of green crops.

XXIV.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

George Armstrong, M. R. D. S.
Bulletins of the Campaign of 1793, 1794, 1795, 1796, 1797, 1798, 1799, 1800, 1801, 1803, 1804, 1805, 1806, 1807, 1808, 1810, 1812, 1813. 18 vols. 8vo. [*London, s. a.*]

The Council of the Royal College of Surgeons in London.
Catalogue . . . . of the Museum of the Royal College of Surgeons in London. Part IV., Fasciculus 1. . . Preparations of Natural History in spirit. 4to. *London*, 1830

The Council of the Royal College of Surgeons in London.
Catalogue of the Calculi and other Animal Concretions . . . in the Museum of the Royal College of Surgeons in London. 4to.
[Part 1.] *London*, 1842
[Part 2.] *London*, 1845

The Council of the Royal College of Surgeons of England.
. . . . *Catalogue* of the Fossil Organic Remains of Mammalia and Aves in the Museum of the Royal College of Surgeons of England. 4to. *London*, 1845

The Council of the Royal College of Surgeons in London.
. . . . *Catalogue* of the Physiological Series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London. Vol. I. . . . . Organs of Motion and Digestion. Second Edition. 8vo. *London*, 1852

The Council of the Royal College of Surgeons of England.
. . . . *Catalogue* of the Osteological Series . . . in the Museum of the Royal College of Surgeons of England. 4to.
Vol. 1. Pisces, Reptilia, Aves, Marsupialia. *London*, 1853
Vol. 2. Mammalia, Placentalia.

THE COUNCIL OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND.
. . . . *Catalogue* of the Fossil Organic Remains of Plants in the Museum of the Royal College of Surgeons of England.
4to. *London*, 1855

THE COUNCIL OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND.
. . . . *Catalogue* of the Histological Series . . . . in the Museum of the Royal College of Surgeons of England. 4to.
Vol. 1. Elementary Tissues . . . *London*, 1850
Vol. 2. Structures of the Skeleton . . . *London*, 1855

THE COUNCIL OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND.
. . . . *Catalogue* of Fossil Organic Remains of Invertebrata . . . . . in the Museum of the Royal College of Surgeons of England.
4to. *London*, 1856

THE COUNCIL OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND.
. . . . *Catalogue* of the Specimens of Natural History in the Museum of the Royal College of Surgeons of England. Vertebrata:—Pisces, Reptilia, Aves, Mammalia. 4to. *London*, 1859

THE COUNCIL OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND.
Catalogue of . . . . the Museum of the Royal College of Surgeons of England.
Part I., Plants and Invertebrate Animals . . . dried.
4to. *London*, 1860

THE AUTHOR.
Cleary (John Francis, Esq., President), Limerick Athenæum. Inaugural Address. Thirteenth Session, 1863–4 *s. l.*, *s. a.* [1864]

THE COUNCIL OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND.
Descriptive Catalogue of the Pathological Specimens contained in the Museum of the Royal College of Surgeons of England. . . .
5 vols. 4to. *London*, 1846–47–48–49
Supplement 1. 4to. *London*, 1863

THE COUNCIL OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND.
Descriptive Catalogue of the Fossil Organic Remains of Reptilia and Pisces contained in the Museum of the Royal College of Surgeons of England. 4to. *London*, 1854

THE AUTHOR.
Flood (Walter Hatton, late Captain H. M. S., . . .). Historical Review of the Irish Parliaments from the Epoch of Henry II. to the Union. . . . 8vo. *London*, 1863

MAJOR ROBERT POORE, 8TH HUSSARS, M. R. D. S.
. . . . *Free Press*. Vols. 3, 4, 5, 6, 7, 8, 9, 10; and the Monthly Supplements from 1856 to 1859.
4to. *London*, *v. a.* [1856–1862]

THE AUTHOR.
Graham (Lieut.-Col. J. D., U. S. Topographical Engineers) . . . . . Report on Mason and Dixon's Line. . . . Second Edition.
8vo. *Chicago*, 1862

The Rev. Beaver H. Blacker, A. M., Booterstown.
History of Inland Navigations. . . . In Lancashire, Cheshire, . . . Staffordshire, ... Derbyshire. Part the Second.
8vo. *London*, 1766

The Council of the Royal College of Surgeons of England.
Hunter (John, F. R. S.). Observations and Reflections on Geology.
4to. *London*, 1859

The Council of the Royal College of Surgeons of England.
Hunter (John, F. R. S.). Memoranda on Vegetation.
4to. *London*, 1860

Mr. James Magahan.
Journal of the Statistical and Social Inquiry Society of Ireland. Seventeenth Session. Part XXVI. January, 1864.
8vo. *Dublin*, 1864

The Rev. Beaver H. Blacker, A. M., Booterstown.
Kenrick (Mr.). Falstaff's Wedding: a Comedy. . .
8vo. *London*, 1760

The Rev. Beaver H. Blacker, A. M., Booterstown.
London Magazine, ... Vol. I. 8vo. *London*, 1820

The Senate of the University of London.
London University Calendar. 1864. 8vo. *London*, 1864

John Ribton Garstin, M. R. D. S.
. . . . . *Marriages, Baptisms, and Burials* . . . . . in the Private Chapel of Somerset House, Strand . . . . . From 1714 to 1776. . . . Index . . . . Genealogical Notes. 8vo. *London*, 1862

The Council of the Royal College of Surgeons of England.
Owen (Richard, ...). Memoir of the Pearly Nautilus, *Nautilus Pompilius*, Linn., with Illustrations . . . 4to. *London*, 1832

The Council of the Royal College of Surgeons of England.
Owen (Richard, F. R. S., . . .). Description of the Skeleton of an Extinct Gigantic Sloth, *Mylodon robustus* (Owen) . . . Observations on . . . Megatherioid Quadrupeds in general.
4to. *London*, 1842

The Minister of Finance, Russia (by M. Le Baron de Brunnow, Ambassador of Russia at the Court of St. James's).
Pander (Dr. Christian Heinrich). Über die Ctenodipterinen der Devonischen Systems. 4to. 9 tab. fol. *St. Petersburgh*, 1858

The Minister of Finance, Russia (by H. E. M. Le Baron De Brunnow, Ambassador of Russia at the Court of St. James's).
Pander (Dr. Christian Heinrich). Über die Saurodipterinen und Cheirolepiden des Devonischen Systems. 4to . . . 17 . . . tafeln folio. *St. Petersburgh*, 1860

Frederick J. Furnivall, Esq.
Philological Society; Proposal for the Publication of a New English Dictionary. 8vo. *London*, 1859

FREDERICK J. FURNIVALL, ESQ.
Philological Society's New English Dictionary :—
List of Books already read, or now (July 12, 1861) being read for. 8vo. *London*, 1861
Basis of Comparison, Part II.—E to L. 8vo. *Hertford*, 1861
Part III.—M. to Z. 8vo. *Hertford*, 1862
Vocabulary of Words beginning with the Letter B. Compiled by *W. Gee*, Esq. 8vo. *Hertford*, 1863

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.
Pleasure Tours in Ireland. . . . an Itinerary . . . Second Edition, 8vo. *Edinburgh*, 1827

THE LITERARY AND PHILOSOPHICAL SOCIETY OF LIVERPOOL.
Proceedings of the Literary and Philosophical Society of Liverpool, Fifty-second Session, 1862-63. No. XVII. 8vo. *Liverpool*, 1863

THE NATURAL HISTORY SOCIETY OF DUBLIN.
Proceedings of the Natural History Society of Dublin, for the Session 1862-63. Vol. IV., Part 1. 8vo. *Dublin*, 1864

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.
. . . . . *Report* of the Protestant Orphan Society, for 1860, 1861, 1862. 8vo. *Dublin*, 1861-62-63

THE MUNICIPAL COUNCIL OF DUBLIN, BY ALEXANDER FARQUHAR, ESQ.
Report of the Special Committee of the Municipal Council of Dublin on the State of the Public Accounts between Ireland and Great Britain. Folio. *Dublin*, 1863

MR. JAMES MAGAHAN.
. . . *Statistical and Social Inquiry Society of Ireland*, . . . List of Members and Corresponding Societies, with the Laws, &c. . . . 8vo. *Dublin*, 1864

THE AUTHOR.
Stoney (Bindon B., . . . C. E.), . . . On the Relative Deflection of Lattice and Plate Girders. . . . 4to. *Dublin*, 1863

THE AUTHORS.
Torrens (Robert R. . . .), and Thomas Dix *Hutton*). Transfer of Land by Registration of Title. Papers read before the Social Science Association, Edinburgh, 1863. . . . 8vo. *Dublin*, *s. a.* [1863]

THE BOTANICAL SOCIETY [OF EDINBURGH].
Transactions of the Botanical Society [of Edinburgh]. Vol. VII., Part III. 8vo. *Edinburgh*, 1863

THE UNIVERSITY OF KIEL.
Transactions. *Schriften* der Universität zu *Kiel* aus dem Jahre 1862. Band IX. 4to. *Kiel*, 1863

(Signed) EDW. RICHARDS PUREFOY COLLES,
Librarian.

March 3, 1864.

BOTANIC GARDEN.

MEADOWS TAYLOR, Esq., *Harold's-cross*:—1 parcel of Indian Seeds.

W. WILSON SAUNDERS, Esq., *Hillfield, Riegate, Surrey*:—128 kinds of Cape Plants.

CHARLES MOORE, C. M. R. D. S., *Director, Botanic Garden, Sydney*:—10 large Tree Ferns, with stems varying from 5 to 7 feet,—*an exceedingly valuable contribution.*

DITTO:—3 packages of Seeds from Australia.

MR. STANSFIELD, *Nurseryman, Todmorden*:—43 rare kinds of British and Foreign Ferns.

MR. JACKSON, *Nurseryman, &c., Kingston-on-Thames*:—11 very rare and valuable Plants.

MR. LOW, *Upper Clapton, London*:—12 Epiphytal and other rare Plants.

W. H. BAILY, Esq., *Museum of Irish Industry*:—6 parcels of New Zealand Seeds.

M. OTTO, C. M. R. D. S., *Inspector, Botanic Garden, Hamburgh*:—19 rare Plants.

Mr. VEITCH, *Nurseryman, King's-road, Chelsea*:—20 very rare and valuable Plants.

MISS BUNBURY, *Picton, Bunbury, Western Australia*:—4 packets of Seeds.

DITTO:—6 kinds of Seeds.

DR. HARVEY, *Professor of Botany*, T. C. D., *&c.*:—From Mrs. BARBER, South Africa, Tubers of a rare Plant.

DITTO:—1 package of Australian Seeds.

DITTO:—5 kinds of Seeds, presented by MRS. BARBER, from Natal.

The REV. GRATTAN GUINNESS, *Beaumont*:—Stem of a Tree Fern from Australia.

MESSRS. LEE, *Nurserymen, Hammersmith, London*:—10 rare and valuable Plants.

M. MAX LEICHTLIN, *Carlsruhe*:—6 rare Plants.

M. LINDEN, *Director of Zoological Garden and Royal Nursery, Brussels*:—12 species of rare Palms.

MESSRS. BACKHOUSE, *Nurserymen, &c., York*:—6 rare Plants.

MR. M'NAB, *Royal Botanic Garden, Edinburgh*:—14 rare and valuable Plants.

DR. CRUGER, C. M. R. D. S., *Director of the Botanic Garden, Trinidad*:—Wardian Case filled with Palms, &c.

M. Ambroise Verchaffelt, *Horticulteur, a Gand, Belgique*:—4 rare Palms.

Mrs. Hill, *Oatlands, Castleknock, Co. Dublin*:—7 kinds of Seeds from Thebes, Upper Egypt; also Fruits of Doom Palm, of "Durra" Grass, &c., for Museum.

Robert Mallet, M. R. D. S., 11, *Bridge-street, London*:—7 kinds of Seeds from New Zealand.

M. Louis Van Houtte, C. M. R. D. S., *Horticulteur, a Gand, Belgique*:—12 very rare Plants, principally Palms.

N. Moe, *Botanisk Gartner, Christiania, Norway*:—159 *very rare and valuable* Alpine Plants.

Herr H. Wendland, C. M. R. D. S., *Director, Botanischer Garten, Herrenhausen, Hanover*:—17 very rare Plants, chiefly Palms.

Herr Weilbach, *Inspector, Botanisk Garten, Copenhagen*:—36 species of rare Plants.

Dec. 1, 1863. (Signed) D. Moore, *Curator*.

NATURAL HISTORY MUSEUM.

Captain Stokes, R. E., *Ordnance Office, Lower Castle Yard*:—A collection of Shells, &c., from the Mauritius.

Bernard Ross, Esq., 21, *Hardwick-street*:—A collection of Birds, Mammals, and of Ethnological Specimens from the northern portion of the Hudson's Bay Company's possessions.

Miss F. Daniel, 30, *Lower Baggot-street*:—A Vase of polished Syenite from the Island of Elephantine, in Egypt.

James Sayers, M. D., M. R. D. S.:—A set of Glass Models illustrative of the crystalline form of Fluor Spar.

Dr. Dickie, Professor of Botany, *Aberdeen*:—4 single valves of *Pecten Islandicus*, and 1 specimen of *Astarte compressa*.

D.H. Kelly, Esq., 51, *Upper Mount-street*:—A case containing 4 stuffed Ruffs (*Machetes pugnax*), 1 Reeve, and 1 young Bird.

Robert Battersby, M. D., *Maison Pinchinat, Cannes, Alpes Maritimes, France*:—A small collection of Fish from the Mediterranean Sea.

Charles Langley, Esq., *Archerstown, Thurles, Co. Tipperary*:—A black Redstart (*Phœnicara tithys*), a young male, shot at Archerstown.

Lieut. H. D. Crozier, R. E., *King William's Town, British Kaffraria*:—A collection of Shells from the Mauritius, and 2 stuffed specimens of the Napu (*Tragulus Javanicus*).

R. E. Power, M. D., R. M. S., *Trent, St. Thomas's Island, West Indies*:—29 specimens of Humming Birds.

ROBERT WARREN, Esq., Jun., *Moyview, Ballina, Co. Mayo*:—A Little Auk (*Alca alle*).

CHARLES P. RIALL, Esq., *Old Conna Hill, Co. Dublin*:—A Pheasant (*Phasianus torquatus*).

CAPTAIN RICHARDS, R. N., Hydrographer to the Admiralty, *Admiralty House, London*:—A collection of Birds, Birds' Eggs, Shells, Fossils, &c., made during the survey at Vancouver's Island and other localities, by C. B. Woods, Esq., M. D., Surgeon to H. M. S. Hecate.

D. J. ROWAN, C. E., *Dundalk*:—3 specimens of Granite from Newry.

R. C. COOK, Esq., *Office of the Commander of the Forces, Royal Hospital, Kilmainham*:—The Skull of a Dolphin (*Delphinus delphis*).

THE BOARD OF TRINITY COLLEGE:—A valuable collection of Plaster Casts of Irish Fish, made by Mr. T. Cullen, under the direction of the late Dr. Robert Ball.

(Signed) ALEXANDER CARTE, M. D., *Director*.

Feb. 3, 1864.

INTELLIGENCE.

DISTRIBUTION OF PRIZES TO THE STUDENTS OF THE SCHOOL OF ART.

This annual ceremony took place on 23rd December, 1863,

His EXCELLENCY THE LORD LIEUTENANT presiding.

His Excellency having taken the Chair,

CAPTAIN HENRY SHAW said,—The honour devolves on me, as Chairman of the Committee of Fine Arts, of laying before your Excellency the Annual Report of that Committee, relative to the Royal Dublin Society's School of Art, and, on behalf of the Committee, of thanking your Excellency for the interest you evince in the welfare of the School, by kindly consenting to preside and distribute the Prizes on the present occasion, and thus, by enhancing their value, give an additional stimulus to the industry of the students. The Prizes to be distributed are:—First, those of the Royal Dublin Society; secondly, the Taylor Prize for Composition Painting, which is only competed for by young persons who intend making this art their profession; and, thirdly, those awarded by the Government Inspector. I think it right to inform your Excellency that the new rules laid down by the Department of Science and Art have necessitated considerable changes in our School, and that the Royal Dublin Society has entirely conformed to all the arrangements, in accordance with the views of the Government Department. We have been most fortunate in obtaining a most efficient Head Master and Mistress; and with the assistance of the Second Master, of whose qualification we have had ample experience, we have every reason to be confident as to the success and beneficial results of our School. I also take this opportunity of mentioning to your Excellency that it is contemplated to attach a Gallery of Fine Arts to the Exhibition to be held on the premises of the Royal Dublin Society next year, and in the name of the Committee to express a hope that the Government Department, aided by the efforts of private collectors and artists, may assist

us with the same liberality as formerly, and thus furnish the Art Students of this city with examples of modern Art, and with instances or opportunities of great value. We also anticipate that the National Gallery, which we believe will shortly be opened, will conduce much to the improvement and refinement of the public taste. With your Excellency's permission, I will call on the Assistant Secretary, Dr. Steele, to read the Report of the Committee.

The ASSISTANT SECRETARY then read the Report of the Fine Arts Committee as follows:—

The distribution of Prizes, now about to take place, occurs generally about this time of the year, after the examination held by her Majesty's Art Inspector, who visits the Royal Dublin Society's Schools in the month of October.

The candidates, irrespective of sex, are arranged under three heads:—

The first, or highest class, consist of the male and female pupils of the School of Art, Royal Dublin Society, who compete, first, for local medals; and, secondly, for prizes of books or drawing apparatus. They also compete for silver medals, and other rewards offered by the Society; but the latter are not adjudged by the Art Inspector, but by persons specially appointed by the Society for the purpose, though the distribution of the latter takes place contemporaneously with that of the former.

The local medals are awarded by the Inspector for certain works executed by the pupils, in various stages of instruction in the school, and placed in competition; and after awarding the medals, the works which have obtained them are subjected to a second and severer scrutiny, and such as the Inspector considers worthy of it, he forwards to London, there to compete with other works similarly selected from the works of the pupils of every School of Art throughout the United Kingdom for national medallions. A national medallion, therefore, is the highest honour a pupil can by possibility attain to.

The prizes of books or drawing apparatus, at the option of the successful pupil, are the result of an examination held by the Art Inspector in Practical Geometry, Perspective, Freehand Drawing, and Model Drawing, and a prize may be attained by a pupil in any one of these subjects; but no pupil can obtain more than one prize in the same year, although they may have exhibited sufficient proficiency to entitle them to a prize in more than one of them. Pupils whose proficiency is not sufficient to entitle them to prizes may, nevertheless, pass the examination in any one or more of its branches, in which cases the inspector awards them certificates of having passed.

The number of pupils who have attended during the last two years have varied but little,—the number for the year which has now passed being 348, and for that which preceded it 344. The like may be said of the income derived from fees,—the amount of it being £279 11*s.* 5*d.* and £280 10*s.* 11*d.*, respectively.

Two of the pupils have obtained the highest honors, viz., National Medallions; *thirteen* Local Medals have been awarded; *two* have obtained Honourable Mention; *one* has been forwarded for National Competition; *two more* have been permitted to compete, having previously obtained Local Medals in the same stages, which disentitled them to obtain them at the last examination; *twenty-three* have been successful in passing the examination in one or more of its branches, of whom *twelve* have obtained prizes.

In addition to the above, *three* have obtained the Society's Silver Medals for Artistic Anatomy; *two*, those for Oil Painting; *two*, those for Architectural Drawing, and *one*, Honourable Mention for Oil Painting.

The Taylor Prize of £10 has been obtained by one of the pupils.

There has been a decrease of six in the number of local medals. This is at once accounted for by the fact that within the last year the Department of Science and Art passed a Minute abolishing Prize-Studentships after October, 1868, thereby withdrawing their incentive to compete, namely, the annual renewal of their privileges according as they should obtain local medals. The Committee, however, at the suggestion of the Master, have restored this incentive, by deciding on admitting all who would have been entitled under the former regulations to Prize-Studentships, or to a renewal of the privilege, on a nominal payment of £1 per annum to the Society, that being the amount formerly allowed for them by the Department after the first year.

The beneficial effect of this resolution is already manifesting itself by the fact that the Prize Students, most, if not all, of whom had ceased to attend, are returning.

Next in order come the pupils of Parochial and other Schools for the children of the poor, taught by the Society's pupil-teachers, under the supervision of the Art Master.

There are about 962 pupils of this class; 39 of whom have obtained what are called first grade prizes, that is, prizes for Freehand Drawing and Practical Geometry in the first or simplest grades, the total number who passed the examination being 75.

The utility of such an institution to artisans and mechanics must be evident to every thinking person. How much more excellent would the works of such men be, were the taste improved, and the manipulation refined, by a course of drawing from the beautiful specimens of ancient art! The mere imitation of such works, however, should not be the end in view; but the great object should be to arrive at a knowledge of those great and universal principles based on reason, propriety, and nature. In nature, every thing has a meaning, and likewise in art. The beautiful vases of the ancients have a meaning, their shape agreeing and harmonizing with their use, and their ornamentation with their shape: there cannot be meaning without purpose. The education of the eye is rapidly becoming a branch of general education, and no doubt the time will arrive when drawing classes will be established in every school in Dublin.

Imitation of form is a faculty inherent in all children, and is as capable of cultivation as the voice.

The common argument which we so often hear, of possessing "no taste," should not be allowed to dishearten any one; for taste exists in a greater or less degree in every individual, and its development must be certain, if judicious selection is made of objects for study.

In consequence of the recent Minutes of the Government Department of Science and Art, the regulations of the school as to the times and terms of instruction, and the staff of teachers, have been entirely changed.

In the arrangements of the different classes, the Committee have been influenced—first, by a desire to provide for the artisan, and poorer classes of the community, ample opportunities for the study.

Thus, in addition to two hours on three evenings of the week, heretofore provided, the Committee have arranged for a class for artisans to be instructed on the mornings of Tuesday and Thursday, from 8 to 10 o'clock, the fees for which are 1*s.* 6*d.* per month, or 7*s.* for five months. To this class females are now admissible.

Another object of the new arrangement has been to regulate the fees, so that the students shall pay according to the length of time they may be under instruction. Thus, in the ladies' and gentlemen's drawing class, the fees are 3*s.* per month, or 13*s.* per session, for two hours' instruction in the week. For four hours' weekly instruction the fees are 5*s.* per month, or £1 2*s.* 6*d.* per session. For six hours a week, 7*s.* a month, or £1 10*s.* per session.

The Committee have set apart different hours for instruction in painting from those devoted to the drawing classes, and have for such fixed upon a higher rate of fee. Thus, for instruction in painting during three hours in the week, the fee is 10*s.* a month, or £2 a session; for six hours weekly the fee is 16*s.* a month, or £3 a session.

The Committee have likewise so arranged the rooms for the classes that some are set apart for ladies, and others exclusively for gentlemen.

The Department of Science and Art having announced that it was their intention to superannuate their former zealous and talented Head Master, Mr. Macmanus, the Committee applied to them to recommend them a gentleman qualified to succeed him. Out of several candidates the Committee are fortunate to have selected the present Head Master, Mr. Edwin Lyne, whose qualifications are as follow:—

Certificates to teach,—1st. Elementary Drawing and Colour; 2nd. Painting; 3rd. Drawing and Painting the Figure; 4th. Mechanical Drawing; his having studied Anatomy under Professor Allan Thompson, of Glasgow, and John Marshall, Esq., F. R. S., of London; having studied in the Ecole Impériale des Beaux Arts, and in the Ecole Impériale speciale de Dessin in Paris; also having studied with Leon Conquit, one of the Professors of the Ecole des Beaux Arts; and, lastly, as a student of the Life School of the Royal Academy of London.

The Committee have continued Mr. James Healy as Assistant Master, a position in which he has for many years given so much satisfaction.

In a school attended so largely by ladies, the Committee have long felt the importance of there being attached to it a mistress, whose presence would, no doubt, have the effect of inspiring with confidence the parents of the female pupils.

The Committee consider they have made a most excellent selection in having appointed as Art Mistress a lady so well qualified as Miss Julyan.

Her qualifications are as follow:—

1st. A Certificate to teach Elementary Drawing and Colour; 2nd. A Certificate to teach Painting; and, 3rd. A Certificate to teach Painting and Drawing of the Figure.

These qualifications, combined with a considerable experience in teaching in schools of the Department of Science and Art in London, render Miss Julyan in every respect eligible for the position to which the Committee have appointed her.

With so many advantages which this branch of the Society possesses, and is capable of affording to the public, viz., instruction in Art, the best that can be provided—fees so moderate as to suit the circumstances of all classes of our citizens—suites of rooms particularly well adapted for the purposes to which they are devoted—an ample supply of the best examples,—the Committee consider they are justified in looking forward with confidence to the schools becoming each year more successful and prosperous.

(Signed)

HENRY SHAW, Chairman.

December 21, 1863.

The Prizes were then read out, and presented to each successful candidate by his Excellency. The following is a list of the prizes:—

SOCIETY'S PRIZES.

Artistic Anatomy.—First prize, Edmund R. Byrne, first silver medal; second prize, Miss Matilda Stoker and Thomas M'Neill, equal, second silver medal.

Painting in Oil from the Life.—Miss Sarah Davies, first silver medal; Miss Hester A. Harman, honourable mention.

Copy of Painting in Oil from the Life.—Miss Georgina Birch, second silver medal.

Architectural Design.—Thomas Holbrooke, first silver medal.

The Judges reported that the works of Mr. Edward Labatt and Mr. J. P. Close were very meritorious.

Copy of Architectural Detail.—John Gilbert Kennedy, second silver medal.

TAYLOR PRIZE.

Best Picture in Oil (subject, "Revenge and Pity,")—John Feargus O'Hea, £10.

The following is the Report of the Judges of the Works exhibited in competition for the Taylor Prize:—

"We, the Judges appointed to adjudicate upon the Works of Art Students competing for the Taylor Prizes in 1863, beg to report that we have examined five compositions submitted for our inspection, having for their subject 'Revenge and Pity,' from Collins' Ode on the Passions; and we have to express our great regret that the expectations of the Judges of last year in recommending a defined and simple subject for competition have not been realized.

"In each of these productions we have sought in vain for examples of correct proportion and accurate design; and it is obvious that, while the youthful students have been tempted to indulge largely in the attraction of colour, they have disregarded the more important requirements of patient and conscientious study of the living model.

"To the work of Mr. J. Feargus O'Hea, in which these deficiencies are perhaps the least conspicuous, we recommend a premium of £10 be awarded. We have been unable to take into consideration the single specimen of Landscape Painting submitted to us—the necessary condition set forth in the declaration, that the lady intends to devote herself to Art as a profession, being wanting.

"In the hope that the qualifications to which we have referred as so essential to success in Art studies may in future meet with the attention they imperatively require, we suggest to the Trustees, that, in the ensuing year, the efforts of competing Students should be directed to the production of Drawings or Cartoons on a given subject, and of a size not less than that hitherto fixed for the Historical Class.

"GEORGE HODSON, Bart.
"CATTERSON SMITH, President, R. H. A.
"EDWARD WRIGHT, LL. D."

PRIZES AWARDED BY THE DEPARTMENT OF SCIENCE AND ART—CENTRAL SCHOOL OF ART—PRIZES FOR EXECUTION OF WORKS OF ART.

NATIONAL MEDALLIONS.—Miss Georgina Birch, and Miss Hester A. Harman.

LOCAL MEDALS.—Arthur Flanery, Miss Louisa Lardner, Miss Emily S. Ryder, Miss Anna H. Odlum, Miss Charlotte E. Benson, Anthony Bassiere, Thomas M'Neill, Miss Josephine Fulton, Miss Henrietta J. Coall, Miss Clara S. Bayley, Joseph Watkins, Miss Marcella E. Prindiville (works selected for national competition), Miss Sophia M. Trevor, Francis Walker (works selected for national competition), Miss Matilda Binney (works selected for national competition).

HONOURABLE MENTION.—Miss Elizabeth Fulton, Miss Isabella Carey.

SECOND GRADE PRIZES,

Awarded for Exercises executed in the presence of the Art Inspector in Freehand Drawing, Geometry, Perspective, and Model Drawing.

Thomas Holbrooke, Anthony Bassiere, Miss Josephine Fulton, Miss Mary M. Pettigrew, Charles Henry Bapty, George Brennan, Arthur Webb, Thomas Fielding, Elizabeth M'Ivor.

FIRST GRADE PRIZES,

For Exercises in Freehand Outline Drawing, and Practical Geometry.

Ralph Macklin's School, 40, Camden-street.—Art Teacher, Mr. E. R. Byrne. Prizes awarded, 8; passed, 8.

Model School of the Church Education Society, Kildare-place.—Art Teacher, Mr. W. H. Murray. Prizes awarded, 6; passed, 11.

St. Bride's Parochial School, Bride-street.—Art Teacher, Mr. Byrne. Passed, 3.

St. Catherine's Parochial School, Thomas-court.—Art Teacher, Mr. Francis Walker. Prizes awarded, 2; passed, 8.

St. Mark's Parochial School, Westland-row.—Art Teacher, Mr. Francis Walker. Prize awarded, 1; passed, 4.

St. Michan's Parochial School, Church-street.—Art Teacher, Mr. Walker. Prizes awarded, 8; passed, 5.

St. Peter's Parochial School, 17, New Bride-street.—Art Teacher, Mr. Walker. Prizes awarded, 8; passed, 8.

St. Werburgh's Parochial School, Werburgh-street.—Art Teacher, Mr. Byrne. Prizes awarded, 3; passed, 2.

Tailors' Hall School, Back-lane.—Art Teacher, Mr. Francis Walker. Prizes awarded, 4; passed, 4.

THE LORD JUSTICE OF APPEAL proposed a vote of thanks to his Excellency the Lord Lieutenant for having kindly presided on the present occasion.

MR. G. W. MAUNSELL seconded the motion, which was passed with acclamation.

HIS EXCELLENCY said—I do not know that I ought to put the motion which has been moved and seconded. Perhaps I may assume that there is no one opposed to it. I can assure you, ladies and gentlemen, that it has been a great pleasure to me to come here once more, to have heard the interesting information which is supplied to us, and to have borne my part in the distribution of the medals, whether local or national, to the successful

candidates. I will no longer risk my character by detaining in my hands a cheque for £10, but I transfer it with the greatest possible pleasure and with sincere congratulations to the successful candidate for the Taylor Prize, Mr. O'Hea. I have always thought it was a very wise and considerate piece of forethought on the part of the Royal Dublin Society to add to the many other branches of science and industry which come under their fostering care a School of Design and a department for the cultivation and encouragement of the Fine Arts. To be sure, the subject matter in which we are engaged to-day affords a remarkable contrast—although, I think, not an irreconcileable contrast—to the spectacle which was exhibited in an adjoining building last week. We there saw a goodly array of fat beeves, well-fed sheep, and more than well-fed swine, to say nothing of the poultry of Cochin China. Ladies and gentlemen, all these specimens of animal nature ought also to exhibit, to a certain extent, lines of a good and proper symmetry and proportion, and great pains are taken with them for the purpose. Still we must acknowledge that the contours and outlines which they present to us differed somewhat from the exquisite form of the Venus, or the faultless shape of the Apollo. At all events, I congratulate you that this department of the Fine Arts will receive very shortly a more appropriate accession and aid, and that too within the precincts of this institution, by the opening of the new National Gallery of Ireland. I quite endorse the opinion which Mr. Maunsell, in his spirited and excellent remarks, told me that I used before in congratulating the public in Dublin upon the manifest improvement which, within a very short memory, has taken place in the architectural appearance of the metropolis, in its houses, shop-fronts, schools, hospitals, galleries, and churches of all religious denominations. Even some improvement is traceable in the domestic furniture now used, and in this respect I cordially subscribe to his opinion, that the classes of such an institution as this, by the care which they bestow upon the nicety of hand and accuracy of eye, form the most powerful auxiliary to this improvement that can be imagined; and I trust that those model schools are likely to supply Ireland with a great many Deanes, Lanyons, and M'Carthys. I congratulate the department upon the acquisition made by the engagement of the new principal Master, Mr. Lyne,—a person whose admirable antecedents speak for themselves; and I feel sanguine of the efficiency which will be displayed by Miss Julyan in her new capacity. I am happy to see amongst the distinguished company present one of my own colleagues in the government of this country, Sir Robert Peel, and I feel confident he will never fail to show the utmost sympathy for, and give encouragement to, the interests of this department. I have long felt that Irishmen do not fail in any native susceptibility for art, though they may labour under the disadvantages of not having due cultivation and encouragement of art; but I trust that this institution will have a powerful effect in developing and guiding that native susceptibility which is not only not wanting, but is very marked and distinguished in the Irish character. I thank you for the kind reception you have given me, and beg to express my most cordial wishes for the development and continued success of this institution.

EVENING MEETINGS FOR THE DISCUSSION OF SUBJECTS CONNECTED WITH APPLIED SCIENCE AND ART.

November 16, 1863.

Mr. George Woods Maunsell, in the Chair.

E. D. Mapother, M. D., read a paper, entitled "Suggestions for Improving the Diet of the Irish Labourer." Published.

Mr. James Haughton read a paper on the "Advantages of Vegetarianism,' 'which was followed by an animated discussion.

DECEMBER 21, 1863.

H. R. DE RICCI, M. D., in the Chair.

DR. DAVID MOORE, Curator of the Botanical Garden, read a paper containing an account of a recent Botanical Tour in parts of Scandinavia, Germany, and Belgium. Published.

PROFESSOR DAVY exhibited and explained Mr. Gore's Patent Gas Furnace; and MR. H. DRAPER exhibited some specimens of metals melted in a similar furnace.

JANUARY 18, 1864.

SIR ROBERT J. KANE, F. R. S., in the Chair.

MR. EMERSON J. REYNOLDS read a paper on "Spectrum Analysis." Published.

At the conclusion of the paper, Mr. H. DRAPER made a few observations, and exhibited a specimen of chloride of rubidium, which possesses the remarkable property of ignition when exposed to the air.

The CHAIRMAN spoke in terms of commendation of the paper, and of the valuable results that had followed and were likely to ensue from the application of physics to chemical research.

MR. H. O'HARA read the first part of his paper on the "Supply of Fuel in Ireland."

FEBRUARY, 15, 1864.

MR. JOHN LOCKE, in the Chair.

PROFESSOR DAVY read a paper on "Flax, and the Practicability of its Cultivation in Ireland being extended," which was followed by an important discussion.

MARCH, 21, 1864.

MR. JOHN LOCKE, in the Chair.

MR. H. O'HARA read the second part of his paper on the "Supply of Fuel in Ireland."

MR. RICHARD DONOVAN exhibited and explained his model of an invention for preventing the Injurious Effects of Railway Collisions.

APRIL 11, 1864.

WILLIAM BARKER, M. D., in the Chair.

MR. EMERSON J. REYNOLDS read a paper on "Albumin, and some of its Metallic Compounds." Published.

JAMES METGE BARRY, M. D., read "Notes of a Recent Visit to Queensland," of which the following is an abstract:—

"Queensland extends from 30° south latitude to Cape York, and from the Pacific to 140° west longitude. It is probable the intertropical settlements will form a distinct colony, extending inland to the eastern boundary of Western Australia.

"The coast of Queensland is much more interesting than that of New South Wales; lofty mountains raise their dome-shaped summits to the azure sky, presenting a series of elevations which attain an altitude of 6000 feet; they divide the waters falling into the Pacific from those lost in the interior in swamps and creeks. In the vicinity of Moreton Bay the country assumes a volcanic character; farther inland fertile valleys are met with, nourished by permanent streams; no part of Australian territory is so well supplied with navigable rivers and fertilizing rills as Queensland. The Clarence is navigable for vessels of 200 tons fifty miles; the Richmond for 100 miles, having a depth of two

fathoms; the Brisbane navigated by ocean steamers thirty miles, and by river craft to Ipswich, 59 miles further. The "Mary," after passing through the richest and most heavily timbered districts of the colony, discharges itself into Wide Bay. The Boyne falls into Port Curtis; and the Fitzroy, the most considerable of the tidal streams of the continent, flows into Keppel Bay; it is formed by a junction of the Dawson, M'Kenzie, and Comet. The important town of Rockhampton is situated on this river, fifty miles from the sea. The banks are covered with high grass; some places are lightly timbered, and penetrated by deep lagoons. Cotton, tobacco, rice, sugar, and arrowroot, grow luxuriantly in the vicinity of Rockhampton. Traces of gold are visible almost everywhere in this district.

"The most important roadsteads of Queensland are Moreton, Wide, and Keppel Bays. Moreton Bay, formed by Stradbrook, Moreton, and Bribbie Islands, is sixty miles long. The principal entrance, between Moreton Island and the main, is eight miles wide, with soundings of from five to six fathoms; the Bay is studded with islands, some of which are picturesque. The Brisbane River, falling into Moreton Bay, was discovered by Mr. Oxley, in 1823, and a penal settlement formed on its banks, which was continued until 1841. Queensland did not begin to prosper until separated from New South Wales, in 1859. Convict labour has not done much for this colony. The beautiful cypress pine trees on Moreton Island were cut down, owing to the superintendents being paid a percentage for every acre cleared; they of course chose the most lightly timbered land. A wharf was constructed at Eagle Farm, but a bank in the river between it and the deep water rendered it useless. The colony was pronounced unsuitable to the growth of rice, arising from the grain having been sown in its manufactured condition. There is a bar off the mouth of the Brisbane River, having nine feet six inches on it at high water; £2000 has been expended on a dredge, which is employed cutting a channel, through which it is expected vessels drawing sixteen feet of water will be able to pass.

"The scenery of the Brisbane River is exceedingly pretty: however weary or anxious the voyager may be, he must be charmed with the scene presented to his view—flowered slopes, clothed with shrubs and trees, traversed by winding paths, nature's liberality helped with a little art and industry. On one estate there is a vineyard of four acres, containing 4000 vines; an acre of pine apples; four acres of bananas, with as much more land devoted to oranges, peaches, figs, and olives. Arrowroot, green vegetables, and sweet potatoes may be seen in the gardens surrounding picturesque cottages. English bees are very generally kept, who wage an exterminating war against the stingless bee of the colony. As we approach Brisbane the stream narrows, and is enclosed between rocky banks, again expanding into a sheet of glassy water.

"Brisbane is situated on the northern bank of the river on the opposite side a town is rapidly rising up. On this side are all the roads communicating with the interior; when railways are constructed to Sidney and Toowomba, the termini will be at South Brisbane. Arrangements have been entered into for constructing an iron bridge to connect North and South Brisbane. The population of the city, together with the suburbs of Kangaroo Point and Fortitude Valley, is upwards of 12,000. The view from the Observatory is one of the finest in Australia; lofty mountains enclose the landscape, detached hills in the intervening country; the noble river winding through rich plains, appearing and disappearing through dark forests, as it pursues its tortuous course. Steps have been taken to supply Brisbane with water and gas. The roads are very good. Some of the public buildings are well designed; Government House is a noble structure; the churches handsome and well ventilated: in no place is the Sabbath more respected than in Brisbane. Some of the private residences are spacious; shops respectable and well-stocked; the markets well supplied, many necessaries of life being cheaper than in this country. The Botanic Gardens, situated on the banks of the river, are exquisitely laid out; the principal promenade is shaded with fine banyan trees, under the grateful shade of which on one of Queensland's warmest summer days the invalid or the student may recline without feeling the oppressive heat. Exquisite creepers ornament the curator's house; a fine specimen of the Irish arbutus, an English oak, and holly, growing in the vicinity of the banana, fig, and olive, attest the wonderful adaptability of the soil and climate. Majestic bamboos fringe the miniature lake; the magnolia, rice, pepper plant, and tea, represent China. Spices of all kinds are cultivated, with many other useful plants, too numerous to

mention. The quinia-yielding trees of South America have taken kindly to their new home. There is a valuable museum and botanical library attached to the gardens.

"Ipswich, the second town of Queensland, is situated on the Bremer, fifty miles from Brisbane by water; it is a well laid out town, with a population of 5000: in its vicinity is the Boval cotton plantation, 150 acres; each acre produces 300 lbs. of cotton, costing £9; value of the cotton, at 1*s.* 6*d.* per lb., £22 10*s.*; ground per acre worth about £50; the government give a bonus of £10 on each bale. The great difficulty of growing cotton in Queensland arises from want of labour. Some South Sea Islanders have been introduced into the colony, at an expense of £6 each. The cotton plant is a perennial; in Queensland, it is found most desirable to treat it as an annual. Coal is abundant on the Brisbane and Mary Rivers. The Red Bank colliery produces 500 tons weekly. The coals are of a medium quality; they sell for 15*s.* per ton at the shoot. The miners earn from 10*s.* to 15*s.* per day. At Moggle I was shown over Mr. Doyle's farm; the manufactured tobacco which I exhibit was grown there; he realized £25 nett from half an acre of plants. My attention was drawn at this farm to cultivated pasture: wherever grass seeds are sown, the native grass disappears. Milch cattle fed on the indigenous pasture yield three quarts of milk per day; when sustained on cultivated grass, they give eight quarts per diem.

"The climate of Queensland is very salubrious; the death rate fifteen per 1000; the summer heat is inconveniently great, the rest of the year most agreeable. In the year 1863, the greatest heat registered was 101 in the shade, in February; and the lowest, 37 in July. The mean temperature for the year was 69, the summer mean 80, winter 58. Europeans on first arriving in the colony are generally unable to perform an ordinary day's work. After about two years they become inured to the climate, and can then work as at home. The mornings and evenings are most delightful; by industriously using those hours, the noon heat may be avoided. The progress of Queensland has been most rapid. In 1859, her broad territory numbered but 25,000 souls, now increased to 60,000. The area employed for agricultural purposes has doubled; the labour wants of the colony have daily increased, and fresh arrivals are quickly absorbed into the community. In 1863, 184,000 lbs. weight of clean cotton was exported, the value of which was estimated at £3500, while in 1862 but 14,844 lbs. were produced: all this has been accomplished by free labour. The cultivation and manufacture of sugar are increasing yearly: in December last, twenty acres of canes were nearly ripe at Cleveland. The growth and manufacture of arrowroot now forms a permanent part of the Queensland agricultural system. In 1860, the quantity of wool exported was five million lbs.; in 1861, seven millions; in 1862, eight millions, in 1863, probably ten million lbs. In 1863, there were in Queensland 34,345,901 sheep, 610,294 horned cattle, 35,625 horses, 7019 swine. The progress of mining has also been satisfactory. The Peak Down Copper Company have commenced smelting operations, and a second company has started under auspicious circumstances. Three gold fields have been proclaimed,—Peak Down, Calliope, and Talga. 823 ounces of gold have been exported; recently a nugget seventeen lbs. has been found at Calliope. The imports into Queensland in 1860 were valued at £74,223; in 1861, at £967,950; in 1862, £1,820,225, rather more than £29 5*s.* per head of the population; while in 1863, the imports reached one million and a half. The exports of 1860 were valued at £523,476; in 1861, £709,598; 1862, £748,519; in 1863, at £888,381, nearly all the produce or manufacture of the colony. The revenue for 1860 was £178,589; the receipts for the last year will, I believe, exceed £317,000. Although 20,000 emigrants arrived in the colony in 1863, there is no labour to spare.

"As a field of emigration, Queensland is especially suited to the Irish working class. Under the present land order system, each steerage passenger receives on arrival an order for eighteen acres, the government value of which is £1 per acre. He may select his own land, and, should he not wish to farm it, can dispose of his claim often at a much higher figure than the government valuation. I have seen an acre of land in the vicinity of Brisbane disposed of for £1000; it is a common circumstance for land in the vicinity of towns to increase in value in two years from £1 to £250 per acre. People with large young families should not entertain the idea of emigrating, nor is there any opening for persons of literary pursuits. Men with hard hands, and willing to use them, are the class most needed in a country like Queensland. Persons, however, with capital, can

invest it to great advantage, either in houses or lands, and obtain a peaceful and happy home in the bosom of nature. I have seen the residences of some such extremely picturesque, surrounded with vines, oranges, bananas, and pine apples, with, outside all, a stately fringe of bamboos. The working man can also make himself very happy, if he be of industrious and temperate habits: the government rate of wages is 5*s.* 6*d.* per day; carpenters, and the allied trades engaged in building, can earn £1 per day. Thus Queensland opens her arms with liberal welcome to all classes able and willing to work. And Irishmen, who must needs seek a home far away from their own beautiful green isle, can do so with prospects as bright as the Austral sky which covers Queensland with an azure canopy all the year round."

Dr. Barry concluded his paper with some observations on the origin and habits of the Aborigines.

May 23, 1864.

Mr. Gilbert Sanders, in the Chair.

Mr. William Andrews read a paper on the "Present State of the Sea Fisheries of Ireland, chiefly with reference to the question of Trawling."

June 20, 1864.

Mr. John Locke, in the Chair.

Edward Haughton, M. D., read a communication on the "Human Body as a piece of Mechanism," which was followed by an interesting discussion.

JUNE, 1863.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Monday, ...	30·120	70	74	72	74	56	S. W.	10	Many, . .	Broken, . .	. .	Sultry, warm day.
2 Tuesday, ...	30·100	69	73	70	73	58	W.	10	Do. . .	Do. . . .	. .	Do.
3 Wednesday, . . .	29·950	67	68	66	69	52	W.	10	Do. . .	Do. . . .	·040	Breezy, fine day.
4 Thursday, . . .	29·950	59	62	59	64	45	N. W.	8	Do. . .	Do. . . .	·160	Heavy showers, frequent.
5 Friday, ...	29·550	57	60	59	60	40	S. W.	0	Do. . .	Do. . . .	·190	Very wet day.
6 Saturday, ...	29·860	55	57	55	59	45	N. W.	5	Do. . .	Do. . . .	·090	Showery day.
7 Sunday, ...	29·830	56	59	57	60	48	S. W.	8	Do. . .	Do. . . .	·110	Heavy showers, frequent.
8 Monday, ...	29·450	55	57	55	59	44	W.	6	Do. . .	Do. . . .	·120	Do.
9 Tuesday, ...	29·540	57	59	56	60	48	W.	10	Do. . .	Do. . . .	·180	Showery A. M., fair P. M.
10 Wednesday, . . .	29·520	58	61	59	61	41	S. E.	10	Do. . .	Do. . . .	. .	Very fine day.
11 Thursday, ...	29·570	56	58	55	59	43	N. W.	10	Do. . .	Do. . . .	·400	Heavy rain P. M.
12 Friday, ...	29·600	57	59	57	59	44	N. W.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
13 Saturday, ...	29·870	57	59	57	59	41	E.	10	Do. . .	Do. . . .	. .	Very fine day.
14 Sunday, ...	29·870	65	68	66	69	51	S. W.	5	Do. . .	Do. . . .	·420	Rain A.M., fair P.M.
15 Monday, ...	29·910	68	66	65	66	56	S. W.	10	Do. . .	Do. . . .	. .	Very fine day.
16 Tuesday, ...	29·650	57	61	59	61	52	S. W.	2	Do. . .	Do. . . .	·300	Very wet day.
17 Wednesday, . . .	29·820	61	65	61	65	50	W.	8	Do. . .	Do. . . .	. .	Dull and changeable.
18 Thursday, ...	29·810	60	63	62	64	52	N. W.	6	Do. . .	Do. . . .	. .	Do.
19 Friday, ...	29·750	61	65	63	65	53	N.	10	Do. . .	Do. . . .	. .	Fine, mild day.
20 Saturday, ...	29·630	63	64	62	66	47	S. W.	10	Do. . .	Do. . . .	. .	Do.
21 Sunday, ...	29·700	61	64	62	66	49	S. W.	6	Do. . .	Do . . .	.030	Fair A.M., showery P.M.
22 Monday, ...	29·810	62	67	63	66	48	S. W.	9	Do. . .	Do. . . .	·040	Do.
23 Tuesday, ...	29·930	65	66	65	68	49	S. E.	10	Do. . .	Do. . . .	. .	Fine, breezy day.
24 Wednesday, . . .	30·000	63	68	65	68	50	S. E.	10	Do. . .	Do. . . .	. .	Do.
25 Thursday, ...	30·050	60	64	61	65	46	S. W.	10	Do. . .	Do. . . .	. .	Very fine day.
26 Friday, ...	29·020	61	62	62	66	45	S. W.	10	Do. . .	Do. . . .	. .	Fine, but changeable.
27 Saturday, ...	29·800	60	64	60	64	45	S. W.	10	Do. . .	Do. . . .	. .	Fair, but very stormy.
28 Sunday, ...	29·850	62	66	62	64	46	W.	9	Do. . .	Do. . . .	·010	Breezy and showery.
29 Monday, ...	29·970	64	64	64	67	45	S. W.	10	Do. . .	Do. . . .	·030	Do.
30 Tuesday, ...	30·150	63	68	68	65	45	S. E.	10	Do. . .	Do. . . .	. .	Changeable, but fine.
								242	Total Amount of Rain,		2.120	inches.

JULY, 1863.

DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	Temp.	THERMOMETER. Dry.	Wet.	Max.	Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Wednesday, . . .	29·950	61	65	66	65	55	S. E.	10	Many, . .	Broken, . .	. .	Very Stormy P.M.
2 Thursday, ...	30·100	60	63	62	65	50	S. W.	10	Do. . .	Do. . . .	·080	Showery day.
3 Friday, ...	30·240	60	64	62	65	52	E.	10	Do. . .	Do. . . .	. .	Fine A. M., cloudy P. M.
4 Saturday, ...	30·300	61	64	62	64	48	E.	10	Do. . .	Do. . . .	. .	Fine, sunshiny day.
5 Sunday, ...	30·150	64	66	64	66	49	E.	10	Few, . .	Do. . . .	. .	Do.
6 Monday, ...	30·030	66	69	66	70	50	S. E.	10	None, . .	. . . . . .	. .	Strong breeze, fine.
7 Tuesday, ...	29·224	62	65	63	68	51	S. E.	8	Many, . .	Broken, . .	·180	Wet A.M., fair P.M.
8 Wednesday, . . .	30·200	67	69	67	70	58	W.	10	Do. . .	Do. . . .	·010	Showery A.M., fair P.M.
9 Thursday, ...	30·400	66	69	67	71	52	E.	10	Do. . .	Do. . . .	. .	Very fine day.
10 Friday, ...	30·500	67	70	68	70	50	N. E.	10	Do. . .	Do. . . .	. .	Do.
11 Saturday, ...	30·450	72	76	74	76	56	S. E.	10	Do. . .	Do. . . .	. .	Very warm day.
12 Sunday, ...	30·480	68	70	68	70	50	N. E.	10	Do. . .	Do. . . .	. .	Do.
13 Monday, ...	30·520	67	71	70	72	50	N. E.	10	None, . .	. . . . . .	. .	Do.
14 Tuesday, ...	30·420	67	71	69	71	48	S. E.	10	Few, . .	Broken, . .	. .	Sultry warm day.
15 Wednesday, . . .	30·300	72	75	73	75	58	N. E.	10	Do. . .	Do. . . .	. .	Do.
16 Thursday, ...	30·280	63	66	64	67	52	E.	10	Do. . .	Do. . . .	. .	Fine, breezy day.
17 Friday, ...	30·100	62	66	64	66	53	S. E.	10	Do. . .	Do. . . .	. .	Do.
18 Saturday, ...	29·980	62	65	63	66	49	S. E.	10	Do. . .	Do. . . .	. .	Do.
19 Sunday, ...	29·870	63	66	63	67	40	N.	10	Do. . .	Do. . . .	. .	Warm sultry day.
20 Monday, ...	29·730	57	59	57	60	40	N. E.	10	Many, . .	Do. . . .	. .	Do.
21 Tuesday, ...	29·550	53	57	55	58	39	N. W.	10	Do. . .	Do. . . .	·040	Fine A.M., cloudy and rain P.M.
22 Wednesday, . . .	29·900	57	59	57	60	40	N. W.	10	Do. . .	Do. . . .	·320	Fine, sunshiny day.
23 Thursday, ...	29·910	59	60	59	62	42	N. W.	10	Do. . .	Do. . . .	. .	Do.
24 Friday, ...	29·970	58	61	59	64	45	N. E.	10	Few, . .	Do. . . .	. .	Do.
25 Saturday, ...	30·100	61	64	62	65	49	W.	10	Do. . .	Do. . . .	. .	Gloomy P.M.
26 Sunday, ...	30·200	72	76	75	77	40	N. E.	10	Do. . .	Do. . . .	. .	Warm sultry day.
27 Monday, ...	30·210	63	65	63	68	39	N. W.	10	Do. . .	Do. . . .	. .	Cloudy A.M., clear P.M.
28 Tuesday, ...	30·200	60	65	64	68	41	N. E.	10	Do. . .	Do. . . .	. .	Do.
29 Wednesday, . . .	30·180	63	66	64	69	42	N. W.	10	Do. . .	Do. . . .	. .	Very warm day.
30 Thursday, ...	30·180	61	65	64	69	44	N. E.	10	Do. . .	Do. . . .	. .	Do.
31 Friday, ...	30·050	65	68	66	69	40	E.	10	Many, . .	Do. . . .	. .	Breezy and changeable.
								308	Total Amount of Rain,		·630	Inches.

AUGUST, 1863.

DATE.	BAROMETER		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Saturday, ...	29·850	60	64	61	64	44	S. E.	9	Many, . .	Broken, . .	·010	Light rain P. M.
2 Sunday, ...	29·820	65	67	65	69	48	S. E.	9	Do. . .	Do. . . .	·210	Showery day.
3 Monday, ...	29·800	68	70	68	71	55	S.	10	Do. . .	Do. . . .	·020	Fine breezy day.
4 Tuesday, ...	29·700	67	71	69	71	54	W.	10	Do. . .	Do. . . .	·020	Warm sultry day.
5 Wednesday, . . .	29·750	65	67	65	70	53	S. W.	10	Do. . .	Do. . . .	·040	Showery day.
6 Thursday, ...	29·750	60	63	61	65	54	W.	0	Do. . .	Do. . . .	·600	Very wet day.
7 Friday, ...	29·890	73	76	73	78	62	W.	10	Do. . .	Do. . . .	·020	Fine, breezy day.
8 Saturday, ...	29·820	64	75	72	76	60	S. W.	8	Do. . .	Do. . . .	·280	Showery day.
9 Sunday, ...	29·950	65	69	67	71	59	N. W.	10	Do. . .	Do. . . .	. .	Very fine day.
10 Monday, ...	29·900	67	70	68	70	54	S. W.	10	Do. . .	Do. . . .	. .	Fine A.M., showery P.M.
11 Tuesday, ...	30·150	61	64	63	64	55	W.	10	Do. . .	Do. . . .	. .	Fine, breezy day.
12 Wednesday, . . .	30·000	60	64	61	64	55	E.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
13 Thursday, ...	29·850	60	65	63	65	51	E.	4	Do. . .	Do. . . .	·800	Fair A.M., rain P.M.
14 Friday, ...	29·770	57	60	58	61	50	S. E.	0	Do. . .	Do. . . .	·150	Very wet day.
15 Saturday, ...	29·530	68	72	70	72	60	W.	10	Do. . .	Do. . . .	·230	Fine, breezy day.
16 Sunday, ...	29·650	60	64	62	65	47	S. W.	8	Do. . .	Do. . . .	·080	Showery day.
17 Monday, ...	29·800	62	64	62	65	48	N. W.	10	Do. . .	Do. . . .	·060	Do.
18 Tuesday, ...	29·950	61	65	63	65	45	W.	10	Do. . .	Do. . . .	. .	Fine, breezy day.
19 Wednesday, . . .	30·090	62	65	63	67	49	S. W.	10	Do. . .	Do. . . .	. .	Do.
20 Thursday, ...	30·150	62	65	64	66	48	N. W.	10	Do. . .	Do. . . .	. .	Do.
21 Friday, ...	30·140	63	65	65	67	48	S. W.	8	Do. . .	Do. . . .	. .	Fine, but changeable.
22 Saturday, . . .	30·000	65	67	65	68	45	S. E.	10	Do. . .	Do. . . .	. .	Fine day.
23 Sunday, ...	29·820	67	70	68	72	46	S. E.	8	Do. . .	Do. . . .	. .	Showery day.
24 Monday, ...	29·630	64	66	64	67	42	W.	10	Do. . .	Do. . . .	·090	Showery, and changeable.
25 Tuesday, ...	29·320	55	55	54	60	47	W.	0	Do. . .	Do. . . .	·130	Very wet day.
26 Wednesday, . . .	29·350	58	59	58	60	46	E.	8	Do. . .	Do. . . .	·060	Dull and gloomy.
27 Thursday, ...	29·350	60	62	61	62	52	N. E.	7	Do. . .	Do. . . .	·600	Rain A M, fair P.M.
28 Friday, ...	29·600	54	58	56	58	51	N.	4	Do. . .	Do. . . .	·020	Do.
29 Saturday, ...	29·730	58	61	59	61	40	W.	10	Do. . .	Do. . . .	. .	Very fine day.
30 Sunday, ...	29·820	55	57	55	58	43	W.	10	Do. . .	Do. . . .	. .	Do.
31 Monday, ...	29·828	58	59	58	60	46	N. W.	8	Do. . .	Do. . . .	. .	Fine breezy day.
								236	Total Amount of Rain,		2·920	inches.

SEPTEMBER, 1863.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Tuesday, ...	29·800	57	59	57	59	43	S. W.	4	Many, . .	Broken, . .	. .	Dull and gloomy.
2 Wednesday, . .	29·490	56	56	54	59	50	S.	8	Do. . .	Do. . . .	·300	Showery day.
3 Thursday, . . .	29·600	60	62	60	62	48	S. W.	9	Do. . .	Do. . . .	·030	Do.
4 Friday, ...	29·600	57	59	57	62	47	N. W.	3	Do. . .	Do. . . .	·040	Do.
5 Saturday, . . .	29·680	57	59	57	61	45	W.	8	Do. . .	Do. . . .	·310	Gloomy A.M., fair P.M.
6 Sunday, ...	29·700	57	58	56	59	41	S. W.	4	Do. . .	Do. . . .	·120	Showery day.
7 Monday, ...	29·600	55	57	55	60	40	S. W.	8	Few, . .	Do. . . .	·430	Strong breeze, heavy showers.
8 Tuesday, ...	29·700	53	55	53	57	47	S. W.	0	Many, . .	Do. . . .	·010	Dull and showery.
9 Wednesday, . .	29·780	55	57	55	59	47	S. W.	6	Do. . .	Do. . . .	. .	Fine, breezy day.
10 Thursday, . . .	30·050	57	61	59	61	44	N. W.	8	Do. . .	Do. . . .	. .	Do.
11 Friday, ...	30·190	56	58	56	59	47	W.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
12 Saturday, . . .	30·100	57	60	58	60	50	S. W.	2	Do. . .	Do. . . .	·020	Showery A.M., fair P.M.
13 Sunday, ...	30·250	55	57	55	58	47	S. W.	4	Do. . .	Do. . . .	. .	Dull and mild.
14 Monday, ...	30·280	56	59	57	59	46	S. W.	6	Do. . .	Do. . . .	. .	Do.
15 Tuesday, ...	30·000	57	59	57	60	51	S. W.	0	Do. . .	Do. . . .	. .	Dull and gloomy, like rain.
16 Wednesday, . .	30·000	55	57	55	57	48	N. W.	0	Do. . .	Do. . . .	. .	Do.
17 Thursday, . . .	29·080	57	57	57	61	50	S. W.	6	Do. . .	Do. . . .	. .	Fine day.
18 Friday, ...	29·050	55	57	55	59	49	S. W.	0	Do. . .	Do. . . .	. .	Gloomy and light rain.
19 Saturday, . . .	29·350	50	51	49	56	49	S. W.	3	Do. . .	Do. . . .	·110	Gloomy and showery.
20 Sunday, ...	29·300	54	54	52	56	44	S. W.	9	Do. . .	Do. . . .	·060	Fine A.M., wet P.M..
21 Monday, ...	29·000	51	54	51	55	42	S. W.	0	Do. . .	Do. . . .	·130	Showery day.
22 Tuesday, . . .	28·900	51	55	53	55	45	N. W.	3	Do. . .	Do. . . .	·070	Do.
23 Wednesday, . .	29·100	51	54	51	54	44	N.	3	Do. . .	Do. . . .	·150	Do.
24 Thursday, . . .	29·500	50	52	50	52	41	N. E.	0	Do. . .	Do. . . .	·280	Very wet day.
25 Friday, ...	29·750	51	52	50	53	40	W.	6	Do. . .	Do. . . .	·060	Fine, breezy day.
26 Saturday, . . .	29·970	54	56	54	56	41	S. W.	8	Do. . .	Do. . . .	. .	Do.
27 Sunday, ...	29·950	55	55	54	56	40	S. W.	6	Do. . .	Do. . . .	.160	Fine A.M., wet P.M.
28 Monday, ...	29·650	52	54	52	57	39	S. W.	6	Do. . .	Do. . . .	.080	Showery P.M.
29 Tuesday, . . .	29·700	57	56	54	57	44	W.	7	Do. . .	Do. . . .	. .	Fine, breezy day.
30 Wednesday, . .	29.690	50	52	50	55	43	S. W.	3	Do. . .	Do. . . .	.460	Very wet day.
								130	Total Amount of Rain, 2·770 inches.			

OCTOBER, 1863.

DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Thursday, ...	29·760	51	52	50	53	44	N. W.	4	Many, . .	Broken, . .	·210	Showery day.
2 Friday, ...	29·790	52	54	52	55	41	N. W.	7	Do. . .	Do. . . .	·110	Do.
3 Saturday, ...	29·800	51	53	51	55	40	S. W.	4	Do. . .	Do. . . .	·120	Do.
4 Sunday, ...	29·800	53	54	51	55	42	W.	6	Do. . .	Do. . . .	·160	Fair A. M., showery P. M.
5 Monday, ...	29·790	50	53	50	55	41	N. W.	0	Do. . .	Do. . . .	.300	Wet A. M., fair P. M.
6 Tuesday, ...	29·730	46	49	47	55	29	S. E.	6	Do. . .	Do. . . .	. .	Fine, breezy day.
7 Wednesday, . . .	29·682	50	53	50	53	46	S. E.	0	Do. . .	Do. . . .	·260	Very wet day.
8 Thursday, ...	29·550	54	55	53	55	51	N. E.	0	Do. . .	Do. . . .	·290	Do.
9 Friday, ...	29·400	53	53	50	55	52	N. E.	0	Do. . .	Do. . . .	·090	Dull and cloudy.
10 Saturday, ...	29·400	53	54	52	56	47	S. E.	0	Do. . .	Do. . . .	·030	Showery day.
11 Sunday, ...	29·300	48	50	41	50	46	S.	2	Do. . .	Do. . . .	1.030	Very wet day.
12 Monday, ...	29·050	52	52	50	54	45	S. E.	0	Do. . .	Do. . . .	·600	Do.
13 Tuesday, ...	29·080	55	55	53	57	50	S. E.	4	Few, . .	Do. . . .	·290	Showery A. M., clear P. M.
14 Wednesday, . . .	29·800	55	57	55	57	52	S. E.	0	Many, . .	Do. . . .	·260	Showery day.
15 Thursday, ...	29·430	57	59	57	60	49	S. W.	6	Do. . .	Do. . . .	170	Rain A. M., fair P. M.
16 Friday, ...	29·650	56	58	55	55	45	S. W.	4	Do. . .	Do. . . .	. .	Dull and gloomy.
17 Saturday, ...	29·900	54	55	53	55	45	S.	3	Do. . .	Do. . . .	·050	Do.
18 Sunday, ...	29·660	58	61	59	61	51	S.	6	Do. . .	Do. . . .	. .	Fine, breezy day.
19 Monday, ...	29·700	55	56	54	57	47	W.	0	Few, . .	Do. . . .	·620	Very wet day.
20 Tuesday, ...	30·080	52	53	51	53	41	N. E.	6	Many, . .	Do. . . .	·440	Fine, clear day.
21 Wednesday, . . .	29·950	50	51	49	51	40	N.	0	Do. . .	Do. . . .	·420	Very wet day.
22 Thursday, ...	30·120	51	54	52	54	45	N. E.	3	Do. . .	Do. . . .	·020	Fine, mild day.
23 Friday, ...	30·180	50	51	50	51	44	E.	2	Do. . .	Do . . .	. .	Do.
24 Saturday, ...	30·000	53	54	52	54	44	S. E.	0	Do. . .	Do. . . .	. .	Do.
25 Sunday, ...	29·850	52	54	52	54	44	S. E.	3	Do. . .	Do. . . .	. .	Do.
26 Monday, ...	29·980	51	54	52	55	44	W.	4	Do. . .	Do. . . .	. .	Do.
27 Tuesday, ...	29.800	48	50	48	50	45	W.	0	Do. .	Dr. . . .	·030	Dull and showery.
28 Wednesday, . . .	29·550	47	48	46	50	43	W.	7	Do. . .	Do. . . .	·290	Fine, clear day.
29 Thursday, ...	29·030	45	47	45	48	32	S. W.	2	Few, . .	Do. . . .	·050	Very stormy day.
30 Friday, ...	29·030	42	44	42	45	44	W.	6	Many, . .	Do. . . .	·060	Stormy and showery.
31 Saturday, ...	29·750	45	47	45	48	43	S. W.	2	Do. . .	Do. . . .	·110	Do.
								87	Total Amount of Rain,		6.010	inches.

NOVEMBER, 1863.

DATE. Day. At 4 o'Clock, P.M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Sunday, ...	29·200	42	45	42	45	42	S. E.	4	Many, . .	Broken, . .	. .	Fine, but cold.
2 Monday, ...	29·400	44	45	43	45	44	N. W.	0	Do. . .	Do. . . .	1·400	Stormy, and very cold.
3 Tuesday, ...	29·450	53	55	54	55	35	S. W.	0	Do. . .	Do. . . .	·100	Stormy, wet day.
4 Wednesday, . . .	29·890	52	58	51	53	50	N. W.	0	Do. . .	Do. . . .	·480	Do.
5 Thursday, . . .	30·030	47	48	47	49	44	S. W.	0	Do. . .	Do. . . .	·300	Very wet day.
6 Friday,.	30·350	43	46	44	46	30	E.	3	Do. . .	Do. . . .	·010	Fine, but chilly.
7 Saturday,. . . .	30·050	47	48	46	49	40	S. E.	3	Do. . .	Do. . . .	·020	Breezy and showery.
8 Sunday, ...	30·250	50	51	50	52	43	N. E.	4	Do. . .	Do. . . .	·030	Dull and mild.
9 Monday, ...	30·180	45	45	43	51	35	S	7	Few, . .	Do. . . .	. .	Fine, clear day.
10 Tuesday, ...	29·800	42	43	40	50	38	W.	7	None, . .	. . . . . .	. .	Do.
11 Wednesday, . . .	29·500	43	44	42	47	35	S. E.	6	Many, . .	Broken, . .	. .	Fine, breezy day.
12 Thursday, . . .	30·000	44	46	44	46	34	W.	4	Do. . .	Do. . . .	·020	Dull and cloudy.
13 Friday,.	30·100	53	53	52	55	43	S. W.	6	Do. . .	Do. . . .	. .	Do.
14 Saturday,. . . .	30·100	54	54	52	54	50	S. W.	3	Do. . .	Do. . . .	. .	Gloomy A.M., light rain P.M.
15 Sunday, ...	30·020	54	55	53	56	46	S. W.	6	Do. . .	Do. . . .	. .	Fine, mild day.
16 Monday, ...	29·924	53	53	51	55	48	S. W.	2	Do. . .	Do. . . .	. .	Dull and gloomy.
17 Tuesday, ...	29·900	52	53	51	53	48	S. W.	0	Do. . .	Do. . . .	·020	Do.
18 Wednesday, . . .	29·860	53	54	53	54	50	S.	0	Do. . .	Do. . . .	. .	Breezy and mild.
19 Thursday, . . .	29·700	52	53	52	53	52	W.	6	Do. . .	Do. . . .	. .	Very fine day.
20 Friday, ...	29·500	53	54	52	55	46	S. W.	4	Do. . .	Do. . . .	. .	Fine, mild day.
21 Saturday,. . . .	29·100	50	52	49	53	47	N. W.	3	Do. . .	Do. . . .	·030	Stormy and showery.
22 Sunday, ...	29·580	49	50	48	50	40	S. W.	3	Do. . .	Do. . . .	·040	Dull, wet day.
23 Monday, ...	29·600	50	50	48	50	37	S.	3	Do. . .	Do. . . .	·020	Dull and showery.
24 Tuesday, ...	29·650	48	50	48	51	45	S. E.	6	Do. . .	Do. . . .	·030	Fine, mild day.
25 Wednesday, . .	29·750	53	53	52	54	49	S.	4	Do. . .	Do. . . .	. .	Do.
26 Thursday, . . .	30·080	53	54	53	55	45	S.	6	Few, . .	Do. . . .	. .	Fine, mild day.
27 Friday,.	30·090	50	51	50	51	47	S. E.	4	Do. . .	Do. . . .	. .	Do.
28 Saturday,. . . .	30·080	49	50	49	52	48	S. W.	6	Do. . .	Do. . . .	. .	Very fine day.
29 Sunday, ...	30·000	50	50	49	51	42	S. E.	7	Many, . .	Do. . . .	. .	Do.
30 Monday, ...	29·850	43	45	43	49	41	S. E.	4	Do. . .	Do. . . .	. .	Dull and overcast.
								111	Total Amount of Rain,		2.510 inches.	

DECEMBER, 1863.

DATE. Day. At 4 o'Clock, P. M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Tuesday, ...	29·380	49	50	49	50	37	S. E.	2	Many, . .	Broken, . .	·040	Dull and overcast.
2 Wednesday, . .	29·800	47	49	47	50	34	S. W.	4	Do. . .	Do. . . .	·050	Breezy day.
3 Thursday, . . .	29·800	47	48	46	49	32	S. W.	0	Do. . .	Do. . . .	·370	Snow showers, very cold.
4 Friday, ...	30·030	47	49	47	50	31	S. W.	0	Do. . .	Do. . . .	·400	Cold and stormy.
5 Saturday, . . .	29·850	47	47	45	53	45	W.	5	Few, . .	Do. . . .	·040	Cold, showery day.
6 Sunday, ...	30·020	49	50	49	53	37	S. W.	4	Many, . .	Do. . . .	·020	Fine, mild day.
7 Monday, ...	30·050	48	49	48	50	39	S. W.	2	Do. . .	Do. . . .	. .	Breezy and changeable.
8 Tuesday, ...	29·780	43	45	43	50	42	W.	0	Do. . .	Do. . . .	·180	Gloomy A.M., rain P.M.
9 Wednesday, . .	29·940	42	42	41	48	35	S. W.	6	Few, . .	Do. . . .	·300	Breezy, fine day.
10 Thursday, . . .	30·050	45	47	45	50	38	S. W.	0	Many, . .	Do. . . .	. .	Dull and gloomy.
11 Friday, ...	30·050	49	47	47	50	40	S. W.	0	Do. . .	Do. . . .	·030	Showery and gloomy.
12 Saturday, . . .	30·150	50	52	50	52	48	N. W.	4	Do. . .	Do. . . .	. .	Fine, breezy day.
13 Sunday, ...	30·340	50	52	50	53	46	S. W.	0	Do. . .	Do. . . .	. .	Fine, mild day.
14 Monday, ...	30·340	50	53	51	53	47	S. W.	0	Do. . .	Do. . . .	. .	Do.
15 Tuesday, ...	30·100	49	50	49	51	47	S. W.	2	Do. . .	Do. . . .	. .	Do.
16 Wednesday, . .	29·700	38	38	37	46	37	N. W.	6	Do. . .	Do. . . .	. .	Light rain, sharp breeze.
17 Thursday, . . .	30·300	42	42	40	43	37	N.	7	Do. . .	Do. . . .	. .	Chilly, like frost.
18 Friday, ...	30·450	43	44	43	45	30	W.	4	Do. . .	Do. . . .	. .	Fine A.M. cloudy P.M.
19 Saturday, . . .	30·450	43	43	42	45	41	W.	0	Do. . .	Do. . . .	. .	Overcast, like rain.
20 Sunday, ...	30·130	44	45	43	47	39	W.	4	Do. . .	Do. . . .	. .	Fine, breezy day.
21 Monday, ...	29·950	44	46	44	47	33	S. W.	0	Do. . .	Do. . . .	·010	Dull and gloomy.
22 Tuesday, . . .	30·200	38	38	37	49	38	N. W.	6	Do. . .	Do. . . .	. .	Chilly, like frost.
23 Wednesday, . .	30·000	47	49	47	49	34	N. W.	0	Do. . .	Do. . . .	. .	Fine, breezy day.
24 Thursday, . . .	29·890	49	49	47	49	39	S. W.	0	Do. . .	Do. . . .	. .	Do.
25 Friday, ...	30·000	47	48	47	49	40	S. W.	4	Do. . .	Do. . . .	. .	Fine, mild day.
26 Saturday, . . .	29·750	44	46	44	46	41	S. W.	0	Do. . .	Do. . . .	. .	Do.
27 Sunday, ...	30·100	47	48	47	50	34	S. W.	4	Do. . .	Do. . . .	. .	Do.
28 Monday, ...	29·970	47	49	47	50	35	S.	6	Do. . .	Do. . . .	. .	Do.
29 Tuesday, . . .	29·970	48	48	47	49	46	W.	6	Few, . .	Do. . . .	. .	Do.
30 Wednesday, . .	29·970	49	49	47	49	32	N. W.	4	Many, . .	Do. . . .	. .	Do.
31 Thursday, . . .	29·490	40	41	39	47	36	E.	0	Do. . .	Do. . . .	·720	Stormy, wet day.
								90	Total Amount of Rain,		2·160	inches.

SUMMARY OF TABLES FOR 1863.

THE total amount of rain-fall in 1863 was 26.058 inches, being upwards of 1½ inches less than in 1862;

The driest month, February, when less than half an inch fell during the month;

July next driest, during which less than three-fourths of an inch fell;

October the wettest month, when no less than 6.010 inches fell, being nearly one-fourth of the whole year's rain, and the greatest amount which has fallen in one month, in this locality, during the last twenty years, and probably much longer.

APPENDIX.

METEOROLOGICAL JOURNAL,

KEPT AT

The Royal Dublin Society's Botanic Garden, Glasnevin,

[HEIGHT ABOVE LEVEL OF SEA, 65 FEET.]

FROM

1ST JANUARY, 1864.

JANUARY, 1864.

DATE. Day. At 4 o'Clock, P. M.	BAROMETER. Height.	Temp.	THERMOMETER. Dry.	Wet.	Max.	Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Friday, ...	29·980	36	37	36	41	37	E.	0	Many, . .	Broken, . .	·400	Dull and gloomy.
2 Saturday, . . .	30·350	34	35	34	39	32	S. E.	4	Do. . .	Do. . . .	. .	Strong breeze, very cold.
3 Sunday, ...	30·400	37	37	36	39	32	S. E.	3	Do. . .	Do. . . .	. .	Fine, very cold.
4 Monday, ...	30·400	31	31	31	37	30	S. E.	6	Do. . .	Do. . . .	. .	Breezy A. M., calm P. M.
5 Tuesday, ...	30·200	32	32	31	33	18	E.	4	Do. . .	Do. . . .	. .	Fine, but cold.
6 Wednesday, . .	30·100	27	28	27	32	17	S. E.	6	Few, . .	Do. . . .	. .	Clear, like frost.
7 Thursday, . . .	30·100	29	31	29	31	16	S. W.	0	Many, . .	Do. . . .	. .	Cold, foggy day.
8 Friday, ...	29·820	33	34	33	34	29	S. E.	0	Do. . .	Do. . . .	. .	Dull and foggy.
9 Saturday, . . .	29·650	40	42	40	42	30	S. E.	0	Do. . .	Do. . . .	. .	Stormy A. M., light rain P. M.
10 Sunday, ...	29·780	44	44	42	40	42	S. E.	0	Do. . .	Do. . . .	·010	Dull and gloomy.
11 Monday, ...	29·640	43	45	43	46	29	S.	8	Do. . .	Do. . . .	. .	Breezy and changeable.
12 Tuesday, ...	30·000	44	44	43	46	35	S. W.	7	None, . .	. . . .	·170	Clear, like frost.
13 Wednesday, . .	30·100	40	42	40	44	27	S. E.	6	Many, . .	Broken, . .	. .	Clear A. M., foggy P. M.
14 Thursday, . . .	29·950	41	41	39	44	26	S. E.	0	Do. . .	Do. . . .	·010	Dull and gloomy.
15 Friday, ...	29·900	45	47	45	47	40	S. W.	0	Do. . .	Do. . . .	·040	Dull and hazy.
16 Saturday, . . .	29·900	44	45	43	47	37	S. E.	0	Do. . .	Do. . . .	·050	Dull and showery.
17 Sunday, ...	29·780	40	41	40	42	35	S. W.	4	Do. . .	Do. . . .	. .	Fine, mild day.
18 Monday, ...	29·800	40	40	39	43	31	S.	6	Do. . .	Do. . . .	·280	Fine, breezy day.
19 Tuesday, . . .	29·800	48	48	47	49	40	S.	7	None, . .	. . . .	. .	Very fine day.
20 Wednesday, . .	29·926	41	41	40	46	37	S. W.	0	Many, . .	Broken, . .	·020	Chill, wet day.
21 Thursday, . . .	29·530	49	51	49	51	32	S. W.	4	Do. . .	Do. . . .	·050	Fine, breezy day.
22 Friday, ...	29·430	50	51	49	52	46	S. W.	6	Do. . .	Do. . . .	·030	Do.
23 Saturday, . . .	29·700	41	42	40	50	39	W.	6	Do. . .	Do. . . .	·290	Do.
24 Sunday, ...	30·080	40	42	40	46	33	S. W.	8	Do. . .	Do. . . .	. .	Dull and changeable.
25 Monday, ...	30·200	44	45	44	46	38	S. W.	3	Do. . .	Do. . . .	. .	Do.
26 Tuesday, . . .	29·350	49	49	47	51	42	S. W.	4	Do. . .	Do. . . .	·100	Breezy and showery.
27 Wednesday, . .	29·740	50	51	50	52	44	S. W.	8	Do. . .	Do. . . .	. .	Strong breeze, like rain.
28 Thursday, . . .	30·000	44	44	43	49	40	W.	6	Few, . .	Do. . . .	. .	Clear, like frost.
29 Friday, ...	30·020	47	47	45	48	39	S. W.	4	Many, . .	Do. . . .	. .	Fine, mild day.
30 Saturday, . . .	30·100	47	48	47	49	40	S. W.	7	Do. . .	Do. . . .	. .	Do.
31 Sunday, ...	29·928	43	44	43	44	40	S. W.	0	Do. . .	Do. . . .	. .	Breezy, cold day.
								101	Total Amount of Rain,		1·450	inches.

FEBRUARY, 1864.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Monday, ...	29·700	51	52	50	52	43	S. W.	5	Many, . .	Broken, . .	·020	Strong breeze, cold.
2 Tuesday, ...	29·750	43	43	41	49	39	W.	0	Do. . .	Do. . . .	·380	Cold and wet.
3 Wednesday, . . .	29·920	37	37	36	42	37	W.	6	Do. . .	Do. . . .	·060	Sleety showers, very cold.
4 Thursday, . . .	30·020	39	40	39	44	35	N. W.	4	Do. . .	Do. . . .	. .	Dull and changeable.
5 Friday, ...	30·420	37	39	38	42	37	N. W.	6	Few, . .	Do. . . .	. .	Clear, like frost.
6 Saturday, ...	30·160	37	38	37	39	26	N. W.	6	Do. . .	Do. . . .	. .	Do.
7 Sunday, ...	29·880	34	35	33	39	32	N. E.	0	Many, . .	Do. . . .	·040	Sleety showers, frequent.
8 Monday, ...	29·600	34	35	33	36	19	S. E.	7	Few, . .	Do. . . .	. .	Clear and frosty.
9 Tuesday, ...	29·410	34	36	34	36	25	S. E.	0	Many, . .	Do. . . .	. .	Showers of snow, very cold.
10 Wednesday, . . .	29·500	39	39	38	41	35	N. E.	8	Few, . .	Do. . . .	. .	Fine, clear day.
11 Thursday, ...	29·480	39	42	39	42	28	S. E.	0	Many, . .	Do. . . .	·010	Dull and showery.
12 Friday, ...	29·380	47	47	46	51	41	W.	6	None, . .	. . . . . .	. .	Fine, breezy day.
13 Saturday, . . .	29·800	47	47	46	50	40	S. W.	8	Many, . .	Broken, . .	·030	Very stormy day.
14 Sunday, ...	29·700	48	50	48	51	41	S. W.	4	Do. . .	Do. . . .	. .	Fine, breezy day.
15 Monday, ...	29·600	51	52	50	53	46	W.	2	Do. . .	Do. . . .	. .	Breezy A. M., light rain P. M.
16 Tuesday, ...	29·650	39	39	38	42	38	N.	4	Few, . .	Do. . . .	·050	Sleety showers, very cold.
17 Wednesday, . . .	30·150	42	43	42	44	31	N. E.	6	None, . .	. . . . . .	·160	Fine, clear day.
18 Thursday, ...	30·180	37	38	37	39	24	E.	6	Few, . .	Broken, . .	. .	Breezy, and very cold.
19 Friday, ...	30·218	33	34	33	36	29	E.	5	Many, . .	Do. . . .	.010	Cold and changeable.
20 Saturday, ...	29·850	30	32	30	33	30	E.	2	Do. . .	Do . . .	. .	Very cold day.
21 Sunday, ...	29·720	31	32	30	34	28	E.	6	Do. . .	Do. . . .	. .	Showers of snow, and sharp breeze.
22 Monday, ...	29·800	36	38	36	39	20	N. E.	7	Few, . .	Do. . . .	·020	Clear, like frost.
23 Tuesday, ...	29·900	37	38	37	41	25	E.	8	None, . .	. . . . . .	·030	Snow, and very cold.
24 Wednesday, . . .	29·950	38	39	38	39	22	N. E.	8	Many, . .	Broken, . .	. .	Fine, but cold.
25 Thursday, ...	30·010	38	40	39	40	34	N. E.	8	Do. . .	Do. . . .	. .	Do.
26 Friday, ...	29·930	40	41	40	43	21	N. E.	8	None, . .	. . . . . .	. .	Clear, like frost.
27 Saturday, ...	29·570	35	38	36	38	21	N. E.	0	Many, . .	Broken, . .	. .	Dull and foggy.
28 Sunday, ...	29·570	39	40	39	42	35	E.	0	Do. . .	Do. . . .	·180	Dull showery day.
29 Monday, ...	29·500	48	44	43	45	36	S. E.	7	Do. . .	Do. . . .	·040	Fine mild day.
								132	Total Amount of Rain,		1·030	inches.

MARCH, 1864.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Tuesday, ...	29·690	43	44	43	45	39	E.	5	Many, . .	Broken, . .	·030	Rain A. M., fair P. M.
2 Wednesday, . .	29·700	45	48	46	48	40	E.	8	Do. . .	Do. . . .	·070	Fine, mild day.
3 Thursday, . . .	29·478	43	45	43	47	40	N. E.	7	Do. . .	Do. . . .	. .	Fine, breezy day.
4 Friday, ...	29·280	45	47	44	47	39	S. E.	0	Do. . .	Do. . . .	·450	Very wet day.
5 Saturday, . . .	29·280	45	45	43	48	39	N. E.	4	Do. . .	Do. . . .	·010	Fine, breezy day.
6 Sunday, ...	28·840	41	42	40	43	40	E.	0	Do. . .	Do. . . .	·640	Very wet day.
7 Monday, ...	29·000	40	40	39	43	35	W.	4	Do. . .	Do. . . .	·020	Fair, strong breeze, cold.
8 Tuesday, ...	29·260	32	32	32	35	32	N. E.	0	Do. . .	Do. . . .	·620	Snowy, cold day.
9 Wednesday, . .	29·370	39	39	39	41	28	N. W.	6	None, . .	. . . . . .	·510	Snow A. M., clear P. M.
10 Thursday, . . .	29·340	43	44	43	45	27	S. W.	4	Many, . .	Broken, . .	. .	Frost A. M., thaw P. M.
11 Friday, ...	29·380	44	45	44	47	38	W.	4	Do. . .	Do. . . .	·030	Strong breeze, showery.
12 Saturday, . . .	30·050	47	48	47	49	32	W.	7	None, . .	. . . . . .	·030	Fine, breezy day.
13 Sunday, ...	29·950	50	52	50	53	36	S. W.	4	Many, . .	Broken, . .	. .	Dull and changeable.
14 Monday, ...	29·730	51	53	50	53	46	W.	4	Do. . .	Do. . . .	. .	Strong breeze, like rain.
15 Tuesday, ...	29·820	42	45	44	46	40	N.	0	Do. . .	Do. . . .	·090	Dull and showery.
16 Wednesday, . .	29·910	42	43	42	44	35	S. E.	4	Do. . .	Do. . . .	·050	Do.
17 Thursday, . . .	29·910	40	42	40	44	37	S. E.	5	Do. . .	Do. . . .	·180	Breezy, fine day.
18 Friday, ...	29·620	46	47	45	49	36	E.	8	Do. . .	Do. . . .	. .	Clear, fine day.
19 Saturday, . . .	29·530	47	50	49	52	30	E.	8	Do. . .	Do. . . .	. .	Frost A. M., fine P. M.
20 Sunday, ...	29·580	48	48	47	50	41	E.	8	Do. . .	Do. . . .	·120	Very fine day.
21 Monday, ...	29·700	46	48	47	48	36	N. E.	8	Few, . .	Do. . . .	. .	Fine, clear day.
22 Tuesday, . . .	29·850	46	47	46	47	37	N. E.	8	Do. . .	Do. . . .	. .	Do.
23 Wednesday, . .	29·980	45	46	45	48	36	N. E.	8	Do. . .	Do. . . .	. .	Do.
24 Thursday, . . .	29·820	46	48	46	48	39	E.	8	Do. . .	Do. . . .	. .	Do.
25 Friday, ...	29·600	47	48	46	51	28	N.	6	Many, . .	Do. . . .	.010	Cold and showery.
26 Saturday, . . .	29·700	41	43	41	48	30	N. E.	6	Few, . .	Do. . . .	. .	Hail showers, very cold.
27 Sunday, ...	29·550	41	45	44	45	25	S. W.	3	Many, . .	Do. . . .	·030	Frost A. M., overcast P. M.
28 Monday, ...	29·250	45	46	44	46	33	N. W.	4	Do. . .	Do. . . .	·060	Stormy, wet day.
29 Tuesday, . . .	29·550	49	52	50	52	34	N. W.	8	Do. . .	Do. . . .	·040	Fine, sunny day.
30 Wednesday, . .	29·600	49	49	47	52	37	W.	7	Do. . .	Do. . . .	·030	Fine, breezy day.
31 Thursday, . . .	29.400	46	48	46	49	39	S. W.	7	Do. . .	Do. . . .	.060	Fine A. M., heavy showers P. M.
								163	Total Amount of Rain,		2·580	inches.

APRIL, 1864.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Friday,	29·580	39	41	39	45	33	W.	6	Many,	Broken,	·170	Hail showers, very cold.
2 Saturday,	29·900	47	50	48	50	32	S. W.	6	Do.	Do.	·020	Fine, light showers P. M.
3 Sunday,	29·850	56	58	56	59	36	S. W.	6	Do.	Do.	. .	Fine, mild day.
4 Monday,	29·928	57	60	58	60	50	W.	5	Do.	Do.	·030	Fine A. M., showery P. M.
5 Tuesday,	30·050	49	51	49	53	48	N. E.	0	Do.	Do.	.300	Heavy rain A. M., fair P. M.
6 Wednesday,	30·100	48	51	49	51	46	N. E.	0	Do.	Do.	·070	Showery A. M., fair P. M.
7 Thursday,	30·124	54	55	54	55	47	E.	6	Do.	Do.	·030	Fine, mild day.
8 Friday,	30·240	55	57	56	57	48	S. E.	3	Do.	Do.	·020	Do.
9 Saturday,	30·240	56	57	56	58	49	S. W.	6	Do.	Do.	. .	Do.
10 Sunday,	30·020	56	58	57	59	48	S. W.	8	Do.	Do.	. .	Do.
11 Monday,	30·000	51	53	52	56	41	N. W.	9	Do.	Do.	. .	Sultry, warm day.
12 Tuesday,	29·950	50	52	50	54	32	N. E.	9	Few,	Do.	. .	Fine, breezy day.
13 Wednesday,	29·900	51	54	52	55	31	S. E.	9	Do.	Do.	. .	Do.
14 Thursday,	29·650	53	54	52	55	44	S. E.	8	Many,	Do.	. .	Do.
15 Friday,	29·720	51	54	52	54	42	N. W.	9	Do.	Do.	·010	Strong breeze, fine day.
16 Saturday,	29·830	52	54	52	54	32	N. W.	9	Do.	Do.	. .	Do.
17 Sunday,	29·950	53	54	53	55	34	N. W.	9	Do.	Do.	. .	Fine, sunny day.
18 Monday,	29·880	57	58	57	58	44	S. W.	9	Do.	Do.	·020	Fine A. M., overcast P. M.
19 Tuesday,	29·680	55	58	55	58	46	S.	7	Do.	Do.	. .	Fine, breezy day.
20 Wednesday,	29·690	53	55	53	56	50	S. E.	6	Do.	Do.	. .	Strong breeze, changeable.
21 Thursday,	29·930	57	59	57	60	51	E.	9	Do.	Do.	. .	Gloomy A. M., sunny P. M.
22 Friday,	30·150	58	62	60	62	44	E.	9	None,	. . . . . .	. .	Warm, sunny day.
23 Saturday,	30·170	60	65	63	65	34	E	9	Do.	. . . . . .	. .	Do.
24 Sunday,	30·150	56	58	56	59	35	N. E.	9	Many,	Broken,	. .	Fine, mild day.
25 Monday,	30·140	56	59	57	59	39	E.	9	Do.	Do.	. .	Do.
26 Tuesday,	30·120	49	52	50	53	43	N. E	9	Do.	Do.	. .	Breezy, fine day.
27 Wednesday,	30.170	50	53	52	55	45	N. E.	9	Few,	Do.	. .	Fine sunny day.
28 Thursday,	30·130	54	57	55	57	37	E.	9	Do.	Do.	. .	Do.
29 Friday,	30·130	54	56	54	55	32	N. W.	9	Many,	Do.	. .	Clear A. M, cloudy P. M.
30 Saturday,	30·080	53	54	53	57	36	N. E.	6	Do.	Do.	. .	Do.
								217	Total Amount of Rain,		·730	inches.

MAY, 1864.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day. At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Sunday, ...	29·900	57	60	58	60	50	W.	8	Many, . .	Broken, . .	·030	Fine, mild day.
2 Monday, ...	29·850	56	59	57	60	49	S. W.	6	Do. . .	Do. . . .	·040	Showery day.
3 Tuesday, ...	29·800	58	60	58	61	48	W.	8	Do. . .	Do. . . .	·160	Do.
4 Wednesday, . . .	29·750	57	60	57	60	49	W.	9	Do. . .	Do. . . .	·080	Do.
5 Thursday, . . .	29·790	54	55	53	56	40	S. W.	4	Do. . .	Do. . . .	·070	Do.
6 Friday,.	29·790	56	57	56	58	40	S. W.	5	Do. . .	Do. . . .	·480	Rain A. M., fair P. M.
7 Saturday,. . . .	29·820	55	57	55	59	37	E.	9	Do. . .	Do. . . .	. .	Fine, sunny day.
8 Sunday, ...	29·630	57	59	57	60	41	E.	6	Do. . .	Do. . . .	. .	Fine A. M., overcast P. M.
9 Monday, ...	29·630	48	49	47	49	46	S. E.	0	Do. . .	Do. . . .	·280	Very wet day.
10 Tuesday, ...	29·880	57	58	57	59	47	E.	7	Do. . .	Do. . . .	. .	Fine, breezy day.
11 Wednesday, . . .	29·880	50	52	50	53	48	N.	2	Do. . .	Do. . . .	. .	Dull and cloudy.
12 Thursday, . . .	29·950	50	59	57	59	48	S.	9	Do. . .	Do. . . .	. .	Fine, breezy day.
13 Friday,.	30·060	57	59	57	59	50	E.	9	Do. . .	Do. . . .	. .	Do.
14 Saturday,. . . .	30·100	57	65	63	65	50	S. E.	0	Do. . .	Do. . . .	·050	Drizly, wet day.
15 Sunday, ...	30·100	65	68	66	72	51	S. E.	9	Few, . .	Do. . . .	. .	Warm, sultry day.
16 Monday, ...	30·100	67	70	68	71	50	S. E.	9	None, . .	. . . .	. .	Do.
17 Tuesday, ...	30·180	70	74	73	74	52	E.	9	Do. . .	. . . .	. .	Do.
18 Wednesday, . . .	30·250	70	72	71	72	50	S. E.	9	Many, . .	Broken, . .	. .	Breezy, fine day.
19 Thursday, . . .	30·200	70	74	72	74	51	E.	9	Do. . .	Do. . . .	. .	Do.
20 Friday, ...	29·950	70	72	70	73	50	S. E.	8	Do. . .	Do. . . .	·080	Thunder, heavy rain.
21 Saturday,. . . .	30·070	66	68	67	69	49	S. E.	9	Do. . .	Do. . . .	. .	Fine, breezy day.
22 Sunday, ...	30·060	54	55	54	56	47	S. W.	3	Do. . .	Do. . . .	·040	Showery day.
23 Monday, ...	30·090	50	54	52	56	48	W.	0	Do. . .	Do. . . .	·110	Gloomy A. M., sunshine P. M.
24 Tuesday, ...	30·200	56	59	59	59	49	E.	6	Do. . .	Do. . . .	·090	Fine, breezy day.
25 Wednesday, . .	30·020	58	62	60	64	48	W.	9	Do. . .	Do. . . .	. .	Do.
26 Thursday, . . .	30·100	53	57	55	57	39	N. W.	8	Do. . .	Do. . . .	. .	Do.
27 Friday,.	30·010	60	61	60	62	34	E.	9	Do. . .	Do. . . .	. .	Do.
28 Saturday,. . . .	30·040	57	62	60	62	41	N. W.	9	Do. . .	Do. . . .	. .	Do.
29 Sunday, ...	30·000	53	55	53	56	37	N. W.	6	Do. . .	Do. . . .	. .	Fine, but changeable.
30 Monday, ...	29·900	50	54	52	55	39	N. W.	5	Do. . .	Do. . . .	. .	Do.
31 Tuesday, ...	29·740	50	54	51	54	33	W.	8	Do. . .	Do. . . .	·080	Fine, breezy day.
								207	Total Amount of Rain,		1.590	inches.

JUNE, 1864.

DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	BAROMETER. Temp.	THERMOMETER. Dry.	THERMOMETER. Wet.	THERMOMETER. Max.	THERMOMETER. Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	CLOUD. Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Wednesday, . . .	29·760	52	55	53	57	35	N. W.	9	Many, . .	Broken, . .	. .	Fine, breezy day.
2 Thursday, ...	29·800	55	58	56	58	37	E.	9	Do. . .	Do. . . .	. .	Do.
3 Friday, ...	29·990	57	58	56	58	35	E.	9	Do. . .	Do. . . .	. .	Fine, sunshiny day.
4 Saturday, ...	29·990	57	59	57	59	36	E.	9	Do. . .	Do. . . .	. .	Do.
5 Sunday, ...	29·640	60	63	60	64	48	S.	6	Do. . .	Do. . . .	·060	Rain A. M., fair P. M.
6 Monday, ...	29·990	65	67	65	69	51	S. W.	9	Do. . .	Do. . . .	. .	Fine, breezy day.
7 Tuesday, ...	29·990	64	65	64	70	54	S. E.	9	Do. . .	Do. . . .	. .	Do.
8 Wednesday, . . .	29·780	60	65	64	67	52	S. W.	6	Do. . .	Do. . . .	·040	Showery day.
9 Thursday, ...	29·780	61	64	62	65	47	S. E.	9	Do. . .	Do. . . .	·040	Fine, sunny day.
10 Friday, ...	29·720	62	66	64	66	44	S. E.	9	Do. . .	Do. . . .	·020	Strong breeze, changeable.
11 Saturday, ...	29·530	60	64	62	65	46	W.	9	Do. . .	Do. . . .	·050	Do.
12 Sunday, ...	29·600	60	63	60	65	55	W.	4	Do. . .	Do. . . .	. .	Fine, but changeable.
13 Monday, ...	29·500	58	60	58	60	46	N. W.	8	Do. . .	Do. . . .	·090	Heavy showers.
14 Tuesday, ...	29·500	59	61	59	62	45	W.	4	Do. . .	Do. . . .	·070	Do.
15 Wednesday, . . .	29·580	60	65	63	65	47	S. W.	9	Do. . .	Do. . . .	·080	Fine, breezy day.
16 Thursday, ...	29·900	65	68	66	65	45	N. W.	9	Do. . .	Do. . . .	. .	Do.
17 Friday, ...	29·910	60	64	62	65	47	W.	6	Do. . .	Do. . . .	·040	Fair A. M., gloomy P. M.
18 Saturday, ...	30·030	59	64	62	66	49	W.	7	Do. . .	Do. . . .	·020	Fine day, light showers.
19 Sunday, ...	30·150	64	68	66	68	52	S.	8	Do. . .	Do. . . .	. .	Warm, sultry day.
20 Monday, ...	29·930	61	65	63	67	54	N. W.	9	Do. . .	Do. . . .	·030	Strong breeze A. M., showery P. M.
21 Tuesday, ...	30·030	60	62	60	64	50	S. W.	9	Do. . .	Do. . . .	·020	Fine, breezy day.
22 Wednesday, . . .	29·900	60	62	60	64	47	S. W.	8	Do. . .	Do. . . .	.190	Do.
23 Thursday, ...	29·900	61	63	61	63	48	N. W.	6	Do. . .	Do. . . .	·170	Showery day.
24 Friday, ...	29·920	59	62	60	64	47	S. W.	8	Do. . .	Do. . . .	·150	Do.
25 Saturday, ...	29·980	58	60	58	63	69	S. W.	8	Do. . .	Do. . . .	·060	Do.
26 Sunday, ...	29·800	57	62	60	64	46	S. W.	9	Do. . .	Do. . . .	. .	Fine, but changeable.
27 Monday, ...	29·700	57	60	59	60	45	S. W.	8	Do. . .	Do. . . .	. .	Breezy and changeable.
28 Tuesday, ...	29·700	59	60	59	60	44	W.	6	Do. . .	Do. . . .	·010	Do.
29 Wednesday, . . .	29·690	60	64	61	64	47	W.	8	Do. . .	Do. . . .	·080	Do.
30 Thursday, ...	29·900	61	63	61	64	46	W.	8	Do. . .	Do. . . .	. .	Do.
								285	Total Amount of Rain,		1·140	inches.

Nos. XXXII & XXXIII.] OCT. 1864—JAN. 1865. [Price 2s.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

CONTENTS:

PAGE.

1. Mr. Andrews on the Sea Fisheries of Ireland, and with reference to Trawling, . . 295
2. Dr. Davy on Flax, and the Practicability of extending its Cultivation in Ireland, . 324
3. Mr. Ellis on the Reclamation of Bog, ... 352
4. Mr. Joynt's Suggestions for the Amendment of the Arterial Drainage Laws, . . 358
5. Return of Donations to the Royal Dublin Society, ... 387
6. Intelligence, ... 393

Appendix—Meteorological Journal for the Months of July, August, September, October, November, and December, 1864, ... ix

DUBLIN:
HODGES, SMITH, AND CO., 104, GRAFTON-STREET,
BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.
LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.
1865.

M. H. Gill, Printer to the Royal Dublin Society.

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

The Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Registrar:—

Life Membership, ...	£21 0 0
Annual Membership (with £3 3s. Entrance Fee),	2 2 0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15s.

I.—Meetings of the Society.

1. *Stated and Ordinary Meetings.*

The Society meets at 2 o'Clock P. M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday in November.

2. *Evening Scientific Meetings.*

Meetings of the Society and of the Associated Societies, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session. The business is conducted in the following sections:—

I. Agriculture and Rural Economy, and Horticulture.

II. Fine Arts.

III. Natural Sciences, including Zoology, Botany, Physiology, Mineralogy, Geology, Physical and Descriptive Geography.

IV. Experimental Sciences, including Physics, Chemistry, Physiology, Meteorology, and the Mechanical Arts.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society, and in the Quarterly Journal of Science.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5s. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6*d*. each; or to twelve for 5s., available for any of the ordinary Meetings throughout the Session.

The Council and Committees.

The Council, which comes into office in January, meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

Eight Standing Committees are annually elected, as follows:—1. Agriculture; 2. Botany; 3. Chemistry; 4. Fine Arts; 5. Library; 6. Manufactures; 7. Natural History; 8. Natural Philosophy. Besides these are the Evening Meetings Committee and Sectional and occasional Committees.

[*For continuation, see page* 3 *of Cover.*

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

OCTOBER 1864 TO JANUARY 1865.

NOTICE.

The additional Plates, illustrating Mr. Andrews' Paper on the Sea Fisheries of Ireland, are unavoidably held over till the publication of the next Part.

those whom prejudice and interested opinions have induced to volunteer preconcerted statements in support of what they consider just and impartial in their own several cases, or to obtain from them any admission of facts that experience may have taught them. Such instances were strikingly exemplified at the meeting I have just alluded to, and at which no dependence could be placed on the intelligence or on the information of either side.

It is scarcely possible to judge without seeming partiality, or to satisfy minds so imbued; but a decided course, founded upon a proper knowledge of the subject, must result in placing them in their proper positions, without apprehensions of future disputes.

On a visit to London, during the last spring, I accidentally had the opportunity of hearing the fisheries much discussed, especially with reference to Ireland. I regret to say that the views entertained and advanced were not pleasing, nor favourable to this country. It was

The Society

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

The Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Registrar:—

Life Membership, ... £21 0 0
Annual Membership (with £3 3s. Entrance Fee), 2 2 0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15[illegible]

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society, and in the Quarterly Journal of Science.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5s. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6d. each; or to twelve for 5s., available for any of the ordinary Meetings throughout the Session.

THE COUNCIL AND COMMITTEES.

[illegible] Council, which comes into office in January, meets during the Session at [illegible] o'Clock on every Thursday not occupied by the Meetings of the Society. [illegible]ht Standing Committees are annually elected, as follows:—1. Agriculture; [illegible]any; 3. Chemistry; 4. Fine Arts; 5. Library; 6. Manufactures; 7. Natu[illegible]tory; 8. Natural Philosophy. Besides these are the Evening Meetings [illegible]ttee and Sectional and occasional Committees.

[For continuation, see page 3 of Cover.

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

OCTOBER, 1864, TO JANUARY, 1865.

XXV.—*On the Sea Fisheries of Ireland, and with reference to Trawling.* By WILLIAM ANDREWS, M. R. I. A., President of the Natural History Society of Dublin.

[Read May 23, 1864.]

A MEETING was held at the office of Public Works, on the 26th day of March last, for the object of obtaining and receiving such evidence from the men of the trawl boats, and from the hook or line fishermen, as might in some measure modify for each party satisfactory arrangements with reference to the long-disputed appeals against trawling within certain limits of Galway Bay. As, however, the inquiry terminated in no decided views, I have been induced to submit further notes upon the question.

It is a very difficult point to instil proper views into the minds of those whom prejudice and interested opinions have influenced to volunteer preconcerted statements in support of what they consider just and impartial in their own several cases, or to obtain from them any admission of facts that experience may have taught them. Such instances were strikingly exemplified at the meeting I have just alluded to, and at which no dependence could be placed on the intelligence or on the information of either side.

It is scarcely possible to judge without seeming partiality, or to satisfy minds so imbued; but a decided course, founded upon a proper knowledge of the subject, must result in placing them in their proper positions, without apprehensions of future disputes.

On a visit to London, during the last spring, I accidentally had the opportunity of hearing the fisheries much discussed, especially with reference to Ireland. I regret to say that the views entertained and advanced were not pleasing, nor favourable to this country. It was

a country unmanageable—its people indolent, prejudiced, and intractable; and no project for the improvement of the country could with any hope be properly developed; and this bore more particularly on the fisheries, where all attempts through public means or public companies had utterly failed. Even, they asserted, had Irish writers admitted such views. Their arguments, however, were superficial, and their inductions neither sound nor truthful.

Much colouring may indeed have been given to such opinions, when we call to mind the unsuccessful attempts that have been made even so far back as 1838, when a Mr. Davis was managing director of a company with a capital of £300,000, of which capital one-third had been subscribed by five persons in England, for the object of fishing the west and south coasts of Ireland. The means proposed were expensive and complicated, the seat of operations ill chosen; and no results were produced. Equally so was a more recent project, that of the "London and West of Ireland Fishing Company," when the shareholders brought their case before the court, and contended that three-fourths of the capital, £40,000, had since the formation of the company been lost in a few months, the details of which are given in the "Shipping Gazette" of the 18th, and "Saunders's News-letter" of the 20th September, 1857.

The very unfortunate wind-up of what was at one time a most promising investment, before its degeneration into the Royal Irish Fisheries Company (limited), is shown in the "Dublin Gazette" of the 8th of November, 1861. These facts, certainly, give very strong assumptions to their arguments; and when we refer to such statements as given by Mr. Longfield, Q. C., M. P., published late in the last year, in his valuable compilation of the "Fishery Laws of Ireland," and by other writers, we must indeed deplore the apparent melancholy condition of the fishermen of Ireland, and its fisheries. Mr. Longfield, at page 216, informs us—"Nothing can be more disastrous than the present state of the Irish fisheries of all kinds—that of herrings diminished, that of oysters deteriorated, that of salmon declining, the fishermen resorting to the poorhouse, and the boats lying idle on the shore. Naturalists tell us of the wonderful fecundity of fish, and the provision made for their almost exhaustless supply; authentic reports tell of rivers fished out, of shoals of fish diminished or disappearing, and the bounties of Providence wasted and destroyed by man's improvidence."

"Semper tibi pendeat hamus;
Quo minime credas gurgite, piscis erit."

Another, more recent, a work of the present year,—"Mitchell on the Herring,"—gives, whether in ignorance or intentionally, by no means a favourable account of "Irish methods of coast fishing." His views of their capabilities are extremely limited with regard to nets and other appliances, as shown at page 100. On curragh fishing he states,—"The curragh, a boat made of hoops, and covered with canvas, is much employed in fishing herrings on various parts of the coast, and even this peculiar antique boat is sometimes not to be had where it could be of

use." Again, he states—"An equally striking and unusual mode of fishing is or has been practised in Downing's Bay (county of Donegal)." Here it appears that "the poor people, for want of means, sew their blankets and sheets together, often to the number of sixty, for the purpose of forming an equivalent to a net, each getting a share of herrings in proportion, the people having nothing to cover them when their bed-clothes are used in this way." His observations on the effects of trawling, at page 334, are equally absurd, and unnecessarily given.

The foregoing statements have therefore led me to offer some refutation, in explanation of what would naturally appear to be a melancholy state of that branch of our industrial resources, the fisheries; and at the same time I feel called on to justify the proceedings of at least one undertaking for their promotion, and to show how erroneous have been the views so often quoted with regard to it.

The Royal Irish Fisheries Company was formed during a period of deep distress in this country, for the employment and the encouragement of the coast fishermen; and for the promotion of so valuable a branch of industry a Royal Charter was obtained, in June, 1848, through the kind patronage and recommendation of the Earl of Clarendon, then Lord Lieutenant of Ireland, the late Marquis of Lansdowne, and Sir Charles Edward Trevelyan. The first proceedings, and the utility of its operations to the period of its, I may say, degenerating into the "Royal Irish Fisheries Company (limited)," have already been given in papers in this and other societies, and will be found in the "Journal" of this Society, Nos. 22 and 23, for July and October, 1861. It remains only to give a brief outline of its receipts and disbursements.

Although, through Sir Charles Trevelyan, the Treasury waived the usual heavy expenses attendant on the granting of a charter, yet the ordinary fees of office could not be dispensed with. Towards the attainment of the charter and all preliminary expenses on the formation of the project, and also the outlay necessary for the establishment of a station, and commencing the undertaking, £1034 17*s*. 6*d*. was voluntarily subscribed. Of that sum £377 4*s*. 2*d*. was paid on account of the charter, and sums to the extent of £500 11*s*. 10*d*. were paid for all incidents, and for the formation of the station at Dingle, the total disbursed being £938 3*s*.

It is unnecessary to swell up this statement with minor incidents, on account of testing the fishing grounds, fitting up the stations, &c.; but suffice to say that early in 1849 two trawl boats were added to the company, and a number of canoes and other small craft, which gave employment to a number of men, as well as in the stores. The produce of sales of fish taken from February, 1849, to July, 1854, amounted to £4141 18*s*. 8½*d*.; expenses, for the same period, of agents', fish-factors', &c., wages, purchases of salt, plant, and sundry fitments, were £3655 11*s*. 8½*d*. It may be of interest to state that the returns show, for the above period, the quantities of prime fish taken by the two trawl boats and sent to the Dublin market were—of soles, 74,687 pairs; turbot, 1010; brill, 1631; dory, 974; so that I may say up to July, 1854, the

entire working was in a most prosperous state, with a most efficient body of men permanently engaged in the stores and in the boats. Since that period the rates of transit are much reduced, and greater facilities given. The market prices of cured fish are now considerably higher. These results had established a certain success in the undertaking, had provided well fitted-up and commodious stores; and at the time Mr. Stopford transferred to other parties the interest and the established position of the company (the plant being ample), a large store of first quality salt, a stock of well-coopered barrels, and all appliances for the curing of fish, &c., the value was estimated at £3000, that value being largely enhanced by knowledge confirmed and experience gained.

The Royal Charter, granted by her Majesty in Privy Council, was merely in abeyance, the number of shares to constitute it a legal document (owing at that time to the unhappy condition of the country) not having been taken. I am glad to state that the successful results shown were from very limited means, and that by the original undertaking no shareholder was embarrassed, nor shares called in. Good, however, has been effected, by the establishing of an efficient system of trawling, and other improved modes of fishing in Dingle Bay, and which have greatly increased industry and a better knowledge of seamanship among the fishermen. These improvements in trawl gear, nets, long lines, and boats, have since been maintained to the best of their means, and the habits of the fishermen have continued to be industrious and peaceable.

During the time that I was attached to the original undertaking, nearly seven years, all transactions passed through my hands. The returns of agents, the logs of the boats, were each week balanced and inspected; and by practically working with the trawl and other boats at different seasons of the year, a vast amount of practical and scientific knowledge was obtained and confirmed of the habits and seasons of fish, bearings and soundings, and all that information so necessary to command accurate judgment and guidance of the working.

A new element, however, in aid, has come more strongly into operation through the means of "The Trustees for Bettering the Condition of the Poor of Ireland." The funds of this valuable society, of which I have the honour of being a trustee, were formed out of a balance arising from the undisposed of moneys subscribed for the relief of our distressed and starving peasantry during the year of famine, 1822. The objects of that fund having throughout the country been usefully accomplished, it was decided by the "Committee of Management" that the residue remaining in hands should be vested in trustees, and applied to promote the following objects:—

1st. In promoting and encouraging the "coast fishery, both in taking and curing of fish, and that chiefly in affording aid in the construction and repairing of fishing boats; in providing hemp, flax, or twine for the making and repairing of cordage or nets, and procuring hooks, lines, tackle, and other implements used in fishing; and to afford facilities and encouragement to the curing of fish for home consumption."

2ndly. In encouraging the spinning of coarse linen and worsted yarn

for the manufacture of articles more immediately in demand for the use of the peasantry; and that chiefly in affording aid to make or repair wheels, reels, looms, &c.; also in procuring hemp, flax, and wool to be distributed where requisite, &c. The London Relief Committee also, with the most liberal spirit, granted sums to be similarly used. The interest of £15,464 8*s.* 3*d.* New Three per Cent. Government Stock, and both principal and interest of £9300 Consols, have for many years past been most advantageously given in loans for the furtherance of those objects, and at present £7000 is distributed throughout the country. The loans are made free of interest, on the recommendation of two approved securities, to be repaid by easy instalments.

Already considerable good has been effected around the coasts of Ireland, among the fishermen and their families, in the districts of Skerries, Balbriggan, Kingstown, Dalkey, Ringsend, &c.; at Greystones, in Wicklow; on the south coast, at Wexford and Youghal; and on the west, at the Arran Islands, Spiddal, Clifden, and Westport, and at the islands of Innisboffin and Innisturk. Considerable sums have also been advanced to artisans engaged at the "loom." In one district, very recently, seventy-eight fishermen have been assisted, with their families, numbering 333 persons. The advances made to promote the fisheries at Howth have been attended with the best results. Thus much distress has been alleviated, and employment given. In the neighbourhood of Skibbereen and Cape Clear the distress of last year was serious. Sir Robert Peel most kindly transmitted £50; but this, distributed among the fishermen of seven hookers and 127 yawls, was but a trifle, and which money had already been anticipated by the kind clergyman who undertook its disposal for such relief. It was distressing that no security could be offered for any loans the society was willing to grant.

But what we chiefly look to is the improvement of the fisheries, by the introduction of large-class boats, suitable to work with safety and comfort to the men in the generally variable and inclement weather of the Irish coasts. By such trawling has been usefully established, and the herring and mackerel fishery in deep water most successfully carried out. I may mention that through the means of the society several of the finest-class boats at Howth, averaging in value with herring and mackerel nets £675 to £700 each, now fish throughout the herring seasons on the east coast, and during the mackerel season on the south coast, from Kinsale to Cape Clear, and from fifteen to seventy miles from the coast. Three of these boats employ eight men in each; and their families, thirty in number, are engaged in net-making and net-mending. The herring fleet at Howth generally numbered—from the Isle of Man, 100 boats; from Scotland, 50; from Cornwall, 300. The herring fishery has been most successful for the last three years. In 1862, eight boats belonged to Howth that were engaged in that fishery. In 1863, there were twenty-six boats, four of them having mackerel trains. The last season was good; the boats averaged a clearance of £15 per week each; one boat had on one occasion a return of £128 in

the week. For the season the Howth fleet averaged £120 to £150 to each boat, clear profit. The "Express" paper, 13th June, 1863, states that the success of the Howth herring fishery caused only about one-half the number of barrels of Scotch herrings to be imported. Those who employ the Howth fishermen state them to be bold and skilful seamen, quiet and well conducted, but fond of changing their vessels. The superiority of the Rush and Skerries men as seamen and fishermen has been long well known. In every way the herring fishery has been so successful, that boats of large tonnage are preparing, and, through the enterprise of the Messrs. Montgomery (who speak highly of the facilities given by the Board of Public Works), a fine store is being built on the pier at Howth for the barking of nets, and the storing of fishing-gear, spars, &c. The nets are principally manufactured by loom, in Scotland. Some of the fishermen's daughers earn 10*s*. to 12*s*. 6*d*. per week repairing them.* The large boats are now (May) off the south coast, mackerel fishing. Four are from Howth, twenty-six from the Isle of Man, and twenty-eight from Kinsale. The Manx and Howth nets are worth £170 to £200 a boat; the boats, from £200 to £300 each. The season is generally from March to June, and the fishing has been very successful. The fish are readily sold to fish buyers, who go out in boats to meet the mackerel boats. They pack in ice, and send off all the best fish to England; the remainder have good demand in Ireland. French luggers make good fishing off Cape Clear, and cure the mackerel in bulk early in the season. At so remote a period as 1738, it is recorded that His Majesty's Ship "Lively" off Cape Clear fell in with about fifty sail of large two-masted French fishing vessels, decked, and with thirty-five hands in each. They had long trains of mackerel nets, and they also fished with lines for cod, hake and ling. They were on the soundings of the Nymph Bank. Mr. Philip Hoare, of Boot-lane, was kind enough to send me the account of the take of one of the Manx luggers, which made £167 for the week ending 18th May, 1863; she was a boat of fifty-six tons, with a train of eighty-seven pieces of mackerel nets.

These notes are only with reference to a portion of our herring and mackerel fishery, as I have principally to allude to the craft engaged in trawling and line-fishing. I trust, however, so far will show that Mr. Longfield is not justified in his statements with regard to our herring fishery, nor in his reports of the declining state of the salmon fisheries, and of rivers fished out; for a greater quantity of salmon were taken in the rivers during 1863 than for the previous twenty years.† These observations equally apply to Mr. Mitchell's account of "Irish

---

* Messrs. J. and W. Stuart, patent fishing net and twine manufacturers, Musselburgh, whose nets are made by machinery, from the finest quality of Polish Rhine hemp; Messrs Boswell and Co., of Hawkslaw Works, Leven, Fife, also manufacture superior hemp and cotton herring nets.

† The herring season (1864) has been beyond all former years remunerative and successful.

Coast Fishing;" and whatever might have been the practice half a century since, his views are not applicable to the present time, nor with regard to the curragh. The antique boat, as he terms it, is fashioned in a superior manner, as the beautiful model represents, and is one of the finest open sea boats on the coast, encountering with safety the most formidable billows. The men pull her buoyantly over the long swells of the Atlantic. They are supplied with long lines and hand lines, and the quantities of turbot and haddock, besides ling, cod, and gurnards they bring in from long distances, are often surprising. These canoes are well finished: their length 24 feet, breadth 3 feet 10 inches, depth 1 foot 10 inches, neatly covered with strong canvass, well tarred. The canoe carries four men, each man pulling a pair of light paddles; a slender mast is stepped in the bow, with a lug sail. Hand lines are used, and the long lines are stowed in baskets, about 1800 fathoms of lines, with 1200 hooks. The heavy surf that these canoes brave is accurately shown in the drawing. I have beached on Ballybunnion strand, at the entrance of the Shannon, with a frightful roll from the Atlantic breaking. The drawing (No. 3) represents a heavy roll of the sea, and surf which sometimes breaks on the sandy beaches of Smerwick Harbour, coast of Kerry; and where the Feohanagh or Ballydavid River empties into the bay, a continuous roll of billows breaks on the shore. The headland in the distance is Ballydavid, at the eastern side of Smerwick Bay. The Clare canoes were the finest on the coast; and if Mr. Mitchell had in smuggling times seen the fine hardy fellows pulling to sea to meet the large luggers, he would not entertain such a bias as to their antique character.

We now come to that part affecting more particularly the object of this paper—"Trawling." In the first place, it is necessary that the opinions should be put forward of those who imagine they have adduced the strongest proofs of the evils of such a system of fishing. It may be in the recollection of many the discussion that took place in the House of Commons in June, 1863, on Mr. Fenwick, the member for Sunderland, moving an address to Her Majesty to issue a Royal Commission of Inquiry into our Sea Fisheries, with the view of increasing the supply of a favourite and nutritions article of food for the benefit of the public. In the introductory review he entered most elaborately into the present consumption, even to the number of periwinkles annually eaten by the London community. On comparing similar evils, but which proved erroneous, with regard to salmon, as in no previous year were they so plentiful as in 1863, he notices a number of authorities against those unseamanlike and destructive poachers, "trawlers." His views as to the working of a trawl boat are not very practically given.

Mr. Fenwick first introduces the opinions of Mr. Couch, as one of the first naturalists in the country, who states that "Since the practice of trawling has been introduced into this locality (Cornwall), it is the expressed belief of the (line) fishermen that the produce of the fisheries has greatly fallen off. The destruction of the spawn, spawning ground, and food of young fish, is well known; but precise evidence of this could

scarcely be obtained, as all the mess is swept overboard at sea (and the trawlers are too knowing to tell it to shoresmen). The fish are so dreadfully mangled in the trawl net, by being dragged along for miles amid a mass of rubbish, that—Ichthyologist as he was—he could hardly tell what sort of fish they were, and they soon became putrid." The observations of two Billingsgate salesmen are then given who condemn all trawl fish as inferior (forgetful of all the fine turbot and soles they auction off). The opinions of a Cornwall clergyman as to the wholesale destruction of spawn are not worth regard. He next comes to the formidable statements of a captain of a trawler, and of another man, who for the last thirteen years had regularly worked in a North Sea trawler:—"These recount that when the trawl is pulled up, haddocks are found scaled, their eyes knocked out; and other fish with their backs broken, fins gone, gall bladders burst, and fish becoming black and green; plaice with their spots rubbed off, and other damage, besides sweeping overboard as many as 7000 and 8000 unmarketable fish at once. As to spawn, on one occasion (the captain) had three tons in his net, as he estimated by the weight. He had only besides some crabs, and a dozen flat fish." The North Sea man states—"The best test used to ascertain the best fishing ground is the existence of spawn on the ground. The lead is heaved overboard. If it comes up covered with spawn, then the trawl is at once heaved over, and good fishing is expected. The captain considered that a single trawl destroyed hundreds of tons of spawn yearly. The miscellaneous contents of a trawl net were all sorts of fish, spawn, and sea anemones; occasionally the body of a dead man, and portions of bodies, and dead stinking fish killed by other trawls." Such were some among the numerous effusions of trawl garbage with which Mr. Fenwick had to deal, and, with such materials supplied to him, we cannot be surprised at his so earnestly urging the question.

The Rev. R. F. Wheeler, of Whitley, North Shields, gave a lengthy paper in March, 1863, at a meeting of the Tyneside Naturalists' Field Club, being chiefly formed from the replies he had received to the numerous circulars sent out in order that he might be prepared to frame the best means of inquiry either by a Royal Commission or a Committee of the House of Commons.

The greatest of all champions for the hook and line fishermen is Mr. Richard Crick, President of the Fishermen's Committee. His denunciations are strong against the trawl-net:—"The evergaping jaws of this life-destroyer, that receives everything loose in the bottom of the sea—living fish and dead fish, pieces of stone, iron, and coals, masses of sea weed and spawn, and the bones of many a shipwrecked mariner, who lies nine fathoms deep 'in the dark blue sea,' and other relics of the ocean, which the storm has laid beside them, are all jolted along together until the net is filled with this *debris* of the ocean. Five hundred tons of spawn (considerably within the mark) are destroyed in twenty-four hours by four hundred smacks plying on the (south of England) coast." These are the stirring statements that have or-

ganized a Royal Commission, who will no doubt see through this *debris*, and will not be deterred from eating a good turbot or a sole so captured.

Those I have just stated are the views of antagonism exhibited by the fishermen of the English coast. It is now necessary to refer to a few that are similarly disposed in this country.

In 1835 an inquiry was held at Kingstown, at which meeting it was stated that the fisheries had considerably diminished in consequence of the number of boats that followed trawling. Mr. Philip Hoare was anxious for the restriction of trawling, as his boats were principally employed in hook or line fishing. He asserted that numbers of under-sized fish were sold in the markets, sent in by the trawlers—hampers of small turbot, brill, and dory. Captain Clements was of opinion that trawling was injurious in shoal water, from the quantity of small fish seen in the Dublin market. The quantity of spawn destroyed in the sands was destructive to the fishing grounds. The entire of the evidence of the injury caused by the trawls was so contradictory and self-interested, that it would be of no importance to repeat, nor with reference to the evidence of many other inquiries that from time to time the Commissioners had to listen to.

A few selections from inquiries at Galway, Dingle, and Dundalk, will be sufficient, particularly with reference to Galway, where so much controversy has never ceased to exist. At the inquiry in Galway in 1852, by the Harbour Commisioners and the leading gentry of the place, and at which Mr. Anthony O'Flaherty, member for Galway, and the late Henry Grattan, Esq., M. P., proprietor of the Claddagh, took prominent part, four of the principal fishermen of the Claddagh were deputed by the rest to give evidence. These witnesses swore as to spawn, and to the embryo of fish, and to the young regularly formed, being destroyed by the trawl; and that the young fry of turbot, sole, and brill, were disturbed, as these several species of fish spawned in the whole of the clean ground of the bay down to Arran.

The latest inquiry was that held by Lieutenant-Colonel M'Kerlie, Mr. Le Fanu, and Mr. Barry, Commissioners of Fisheries, on the 3rd December, 1863. At that meeting no evidence—caused through intimidation by the Claddagh people—could be had from the trawling men, but only such given by men of the Claddagh that had been employed in the trawl boats. These men all asserted that large quantities of young fish were taken in the trawl nets, and thrown overboard; that the boats had always large numbers of fry of every kind of fish drawn up in the trawls—cod, haddock, and soles. Anthony O'Flaherty, on being sworn, said he was chief boatman at Barna, and knew the bay very well. The supply of fish had decreased very much since trawling began. In 1852 he went on board a trawler, by order of Mr. Barry, to note the fish taken. Large quantities of fish were taken up which were quite unfit for use. The fishery was not one-fourth as productive from the quantities of small fish taken up. Whiting and mackerel were plentiful at one time, but now they are not to be had. Herrings

were frightened away. He was three weeks on board the "Druid" trawler. The boundary line should be removed to Arran. The fishermen do not like to go out for herrings until a certain day, although the fish have been known to be a month in the bay before the men go out. He felt certain that the interests of the public would be served by stopping the trawlers, and leaving the bay to the fishermen. The fry taken up were mostly flat fish—very little round fish.

Mr. Denis Kelly said he was owner of a trawl boat. Trawled in Galway Bay, where the quantities of small fish taken were immense. About half a ton weight of dead fry was thrown overboard every day. Mr. Anthony O'Flaherty, late M. P., bore testimony to the many virtues of the Claddagh people.

At the several inquiries made in Dingle Bay, on the grounds of which the boundary line had been formed, similar evidence was given that the whole bay was spawning ground.

The further investigation held at the Custom House, Dublin, on the 26th March, on the effects of trawling in reference to Galway Bay, was merely to obtain any evidence that may have tended to prove to what extent the fisheries had diminished. No information of importance was elicited from those examined.

The inquiry held with regard to Dundalk Bay, in August, 1862, is a strong proof of the inconsistency of the fishermen. The meeting was convened to rescind the by-law made in February, 1851, against trawling within certain limits. The main evidence was to prove that boats of a certain tonnage allowed to trawl in the shoal water of the bay could not do harm to spawning grounds, and that the fish spawned in deep water. Thomas Carville, of Balbriggan, said he had been a fisherman for the last forty years, with the exception of three years he had been coasting; had trawled all that time in all the bays of the east coast; also was engaged in the herring fishery; both owner and master of a trawl boat of twenty-two tons. Belongs to Balbriggan. His life has been a miserable one since the by-law passed. From his experience, fish spawned in deep water, and came into shallow water to fatten. At this season the shoaler the water, the stronger the fish. White fish did not come into the bay, because there were no trawls to scrape up the ground for them. When asked by a line man when turbot and plaice spawned, his reply was— "When they are ready!" Mr. Good's boats could not trawl in Dundalk Bay, nor in the shoal water off the coast; they drew too much water.

Such are among the very numerous views too often put forward by interested parties, who do not honestly entertain general principles of utility; and too often are such observations more readily supported, to the exclusion of information independently given of results of sound and properly directed investigation.

Now, concisely reviewing the first part of those extracts, we learn from Mr. Fenwick's own statement the enormous quantities of fish sold

in the London market during the year 1862. Compiled as far as accurate returns were obtainable, there were sold in Billingsgate half-a-million of codfish, 25,000,000 of mackerel, upwards of 100,000,000 of soles, 35,000,000 of plaice, 200,000,000 of fresh haddock, besides enormous quantities of shellfish, and also inferior fish; and these returns are far short, and are independent of the supplies to all the leading provincial towns—the consumption at Manchester alone being enormous. These returns are far from showing diminution, and which were equally great in 1863.

In Mr. Barry's report to the Commissioners of Irish Fisheries for 1862, of his "Coast of Devon Inquiry," he gave faithful notes of his observations. He was surprised at the prosperity of Brixham, the comfortable clubroom of the fishermen—in this den of the trawlers, where there were 221 trawling vessels, cutter-rigged, and about 100 smaller-class boats, engaged in hook and line fishing, and no bad spirit existing between either class. He learnt from Mr. Saunders, the harbour-master, that there was no diminution in the supplies, and that each year the vessels were increasing, and were improving in equipment.

Mr. Couch's evidence, and that of those who have given such revolting pictures of the action and of the contents of the trawl net, will be sufficiently refuted when explaining the results of experience on the west coast of Ireland. The Rev. R. F. Wheeler appears only to have been animated with the desire of obtaining and presenting to the public the best information he could select from the numerous replies to his circulars. I cannot, however, avoid animadverting on the erroneous views volunteered by Anthony O'Flaherty, chief boatman at the Barna station of the coastguard, before the Commissioners, Lieutenant-Colonel M'Kerlie, Mr. Le Fanu, and Mr. Barry, at the meeting held at Galway in December, 1863. The examination that took place at Galway in June, 1852, has been already alluded to; and Mr. Anthony O'Flaherty, then M.P. for Galway (not the boatman), was well aware of the violence of the Claddagh men in their intention to sink the "Druid" trawler (see "Galway Vindicator," 16th June, 1852), and of the proposition that had been made to place that vessel at the disposal of the Harbour Commissioners for the object of satisfying all parties, by testing the bay. This subsequently led to O'Flaherty, the chief boatman, going out for that purpose. His journal is published in the report of the Commissioners of Fisheries for 1852, page 19. Of the dependence to be placed on that journal I shall explain by giving extracts from the logs and returns that each week were accurately and regularly kept of all incidents connected with the vessel, the weather, and the takes of fish. The 8th July, 1852, was the first day that Mr. O'Flaherty went out, the wind light at west. The steam sloop-of-war "Geyser," Captain Hand, was in the roadstead. Forty-eight pair of soles, two turbot, one brill, and some rough fish—as hake, gurnards, plaice, and dabs—were taken in the trawl. The "Druid" was threatened by Claddagh men in hooker No. 32, and the coastguard man and crew frightened. The week ending 17th July, a midshipman and three seamen went out in the vessel. The "Druid" trawled four days

that week. The take of fish was great, also, for the week ending 24th July—out five days that week, and trawled four. At five P. M., 21st July, came-to under Blackhead, landed for water; refused by the natives; plenty of water, but none for the vessel. Week ending 31st July—three days out, large take of fish. In place of being out three weeks in the "Druid," O'Flaherty was not more than three times, took no notes; and whatever returns of fish he had were given him by Tuite, the master of the "Druid." The thick slime on the deck that came off the fish he bottled for examination, and those who tested it can vouch for the fragrance. In the week ending the 7th of August I was at the Arran Islands. On the night of the 4th, and morning of the 5th, fresh breeze at S. W., heavy sea on; "Druid" under two-reefed mainsail and two-reefed foresail. I examined, on board, the fish taken. There were 324 pairs of soles, five turbot, forty-three brill, forty hake, six skate, three dog-fish, and a number of small dabs. Mary soles, or lemon dab (*Platessa microcephala*), and the young of rays, and the flapper skate (*Raia intermedia*), also Muller's topknot (*Zeugopterus hirtus*), but not a single fish that could be termed the young or fry of turbot or soles, nor of cod, haddock, or other white or round fish of value. I have examined carefully the trawl nets, and frequently at different seasons, when out in the Bays of Dingle, Kenmare, and Ballinskelligs, to which I shall presently make reference. In reply to O'Flaherty's other statements, that herrings were frightened by the trawl, and mackerel and whiting not to be had, I refer him to the Galway papers of August and September, 1862 and 1863, which state that the harvest herrings were never so plentiful, nor the take so great. Mackerel must be looked for in deep water; and the herrings were parading the bay, notwithstanding the trawlers, a month before the Claddagh boats would go for them.

Late in the month of November, 1862, I visited Galway, and the Claddagh market. There was a hard frost, and, with an offshore wind, smooth water in the bay. It was Saturday, and the market was glutted with cod, hake, pollock, red gurnard, and dory, selling at the cheapest rates; large cod at 10*d*. each. Any trawl fish taken had been sent to Dublin. The cod fish, although of large size, were of inferior quality. The prime sales of the market were the whiting. I never in any locality saw such splendid fish; they were three to four pounds weight, of fine and firm quality. The Dublin market at that time was supplied for more than a week with such fish during the steady weather. I was fortunate in detecting a whiting not hitherto known on the Irish coast.* These gluts of fish altogether depend upon the weather; for if there are not able boats to stand the sea, scarcity will ensue; hence the perpetual broils against the trawl boats. Mr. O'Flaherty must have very little experience of seamanship, or of the bay, when he maintains that a vessel could work outside the Arran Isles in thirty to fifty fathoms, with a heavy roll of the Atlantic, and with the frequent heavy breezes that

* Couch's Whiting, *Merlangus albus* (Couch).

even in summer occur. Mr. Denis Kelly's estimate must indeed be light, when he asserts that half-a-ton daily of dead fry had been thrown overboard from his small craft, when the take of a trawl boat of forty-five tons will not average that weight at each good haul of all kinds of fish. I have dwelt thus long on the incidents of Galway Bay, as it is now the quarter perpetually agitated.

In continuation, I shall submit some explanatory views.

Such statements of evidence so continuously put forward against the system of trawling were not so much that it had injuriously decreased the supplies of fish, but too apparently on account of the superiority of the vessels so employed, and the great and certain returns that generally resulted. These circumstances combined to keep up prejudices, and to exasperate that class of fishermen who followed less sure means of capture, and who could not compete with vessels of such tonnage and gear. During the period when the largest number of boats were working on the east coast, that were chiefly engaged in hook or line fishing, the boats averaging from twenty-five to sixty tons, many inquiries were instituted as to the supposed injurious effects of trawling. A desire was urged on the part of the line fishermen, that boats with beam trawls should not be permitted to fish within five leagues of the land. The hook or line fishermen admitted that they never could supply the Dublin markets solely by the lines; and that fish, in some seasons, were scarce on many parts of the coast, such as cod, ling, and haddock, even in localities where trawling had not been practised. Prime fish, as turbot and soles, could not at the seasons of their best condition be obtained, but through the working of the trawl boats. It has been suggested that trawling should not be permitted within three miles of the shore. The greater part of the coasts of Ireland are very different from those features that characterize the soundings of the channel of the south coast of England, and the opposite shores of France. In Ireland deep bays and inlets are frequent; with deep water soundings close in with the land. Across the Channel, from the shores of England, and of France, the soundings scarcely exceed the depth for the working of the trawls, taking the ranges from the South Foreland to the Scilly Isles, and from Calais to the Channel Islands.

In order to make the subject more clear, it will be necessary—1stly. To give an outline of the features and soundings of those parts of the east and the west coasts where trawling has been carried on. 2ndly. Class of boats and their equipment. 3rdly. The habits and seasons of fish, ranges and causes of scarcity. 4thly. Hook and line boats, failures with regard to their modes.

1st. I shall not touch upon those parts of the coast to the southward of Bray Head, extending to the coasts of Wexford and Waterford, as no disputes of any moment have taken place with regard to trawling.

The best grounds for the working of the trawl boats are on a long range of nearly ninety miles, extending from Bray Head, Wicklow, to Ardglass, in the county of Down, and varying at distances from the land to thirty miles, where the depth of trawling ground across the Channel to the

Isle of Man does not exceed forty fathoms, and in some eighteen to twenty-five fathoms; at twenty miles from the land, the soundings variable from fifteen to sixty fathoms. Along the entire range of the east coast very valuable charts of the soundings were made for the Commissioners of Irish Fisheries from the surveys of the late Alexander Nimmo, C. E., and also by Commander Mudge, R. N. On reference to them, as well as to the more recent surveys of the coast, although there are extensive reaches of sand, and shoal water in the several bays and inlets from Howth to Dundrum Bay, yet the principal features of the coast are characterized by rocky reefs at different points, running to some distance seaward. Thus we have reefs extending about the rough ground near Lambay in six and seven fathom; lines and patches of reefs off Skerries and Balbriggan, with the well-known Cargee Rocks. Clogher Head sends out its line of reefs, and again off Dunany Point. Several patches with shoal water, off Dundalk Bay, and formidable reefs and patches bound the northern shores of Dundalk Bay and the entrance to Carlingford Lough, the Helly Hunter being well known. Again, northerly to Ardglass, and off Dundrum Bay, extensive reefs and rocky grounds prevail, which are dangerous off Annalong and St. John's Point, and the Bay of Killough. These soundings have been well tested by the experienced trawlers of Dublin Bay, who would not venture to work their large craft along that coast, where the soundings off shore vary from two to six fathoms.

In Dingle Bay similar features of extensive reefs run to some distance into the bay, between the reefs being soundings of sand and mud, varying in depth from five to ten fathoms, the rocky and corally bottoms sometimes having a depth of thirty fathoms. These reefs are at different points bounding the whole of the northern and southern shores of the bay. The same characters present themselves in Galway Bay. The recent surveys are very minute as to the depth of water; but the accurate soundings for trawling and the reaches of clear ground can only be known by the working of the boats, and by the experience of noting bearings. Now, as so much has been argued as to the entire of Galway Bay being spawning grounds, it is necessary more immediately to refer to ranges well known as the ground on which the fish spawn. Westward of the notorious Margaretta Shoal and the Henry Ledges, the entire of the main soundings of the bay are clear bottoms, varying with mud and sand, and sand and shells, the depth being from nine to twenty-five fathoms to the Arran Isles. Inside the Arran Isles are many extensive patches of coral reefs, having from seven to nine fathoms soundings, over which no trawl net could work. Along both the northern and southern shores of the bay, extending along the five-fathom line, are extensive ledges of rocks, many running out to seven fathoms in the bay. Reefs and shoals are all along the entire range of shore, and which occur off Ballyvaughan and Gleninagh to Blackhead, and round to the Murrough. The entire of the northern shores present similar protection against the working of the trawls. Immediately outside of the Arran Isles, and also at the entrance of Dingle Bay, there are from thirty-five to fifty and

sixty fathoms, which depths are of greater account from the high running seas that constantly occur during the prevailing winds of that coast.

2ndly. The finest class trawl boats on the Irish coast are those that hail from the port of Dublin, principally from Ringsend and Kingstown. They rate from forty to sixty and seventy tons, and are of superior equipment, to stand the heavy weather experienced, particularly in the spring months, when they work along the north-eastérn ground off the Mourne reaches. To show the superiority of this class of boats, I give in detail* the fitting out of one of Mr. Good's vessels, of sixty-five tons, builder's measurement, her value complete for sea being £1000. The estimated expenses of another boat, of seventy tons, the trawler "Leinster," exceed £1100. From the superior fitment of winches, purchases, &c., these boats can be worked by three men and a boy. The Balbriggan boats used in trawling, as well as those of Dundalk Bay, average from twelve to twenty-five tons, are light in construction, and, drawing a light draft of water, can easily and with safety be worked inshore, especially as, having no winches, they haul the trawl warp in by hand; therefore, not having the purchases the large boats are fitted with, they require more men to work them. Their size, rig, and number of hands enable these small craft to work readily inshore, and to claw off if caught with a breeze and an inshore swell. It can be clearly understood by any experienced seaman that vessels drawing on an average eleven feet, and the heavy trawl gear fifty or sixty fathoms of six-inch trawl warp out, with bridles, and having a beam of forty-five feet span, spreading with a net extending to seventy and eighty feet in length, could not venture to work along the shoal soundings of the coast that I have described, as the vessel could not safely work off with a sea and swell setting on a lee shore. The little craft of Balbriggan and Dundalk, and those of Waterford Harbour, and the boats of the Claddagh that were at one time using trawl nets, could easily and with safety to their gear work over the shallow reaches and in the narrows, which would be destructive to the gear and to the boats of a larger class. In Dingle Bay the boats that work there are of too small tonnage for the heavy seas of that exposed coast, but the means of the poor fishermen will not admit their obtaining abler boats; yet they are fully sensible of the advantage, comfort, and safety, a fine class vessel would be to them.

Having now explained the superiority of a first-class trawl-boat, taking one of Mr. Good's beautiful craft as a model, I will give a slight outline of their importance in other respects.

The subject of the fisheries has engaged the attention of our earliest legislators, and they were at one time desirous to encourage that branch of industry to the greatest extent, as being of vital importance to the maritime power of a nation. And what were the results of such en-

---

* See Appendix.

couragement? Able and experienced seamen, and good pilots—qualities that are not attainable in a day when the country would be in need of such services. We have long felt the evil that so much crippled our Newfoundland fisheries, and that reduced that once great reserve for our royal and our merchant marine, and which has caused our merchant ships to be manned by motley crews of useless and dangerous seamen. Such scenes as occurred on board the "Flowery Land," the "Ponteac" of Liverpool, and other ships, would never have taken place had we our own seaman to depend on. I recollect a charge of cruelty being brought against a captain of a ship who had a mixed crew, for always in hard weather sending the Spaniards and Portugese aloft to reef. His reasons were, that if he sent his English crew aloft, the foreigners would seize the opportunity to overpower the rest and take the ship. The superiority of many of the American ships during the last war was mainly owing to their being manned by picked seamen, while our ships were served with a mixture of landsmen untrained to the guns. On the other hand, how many instances are recorded of the daring seamanship and gallantry of our seamen fishermen! During the last winter the columns of the "Times" constantly detailed the numbers of lives rescued and ships saved by the men of our English fishing smacks. Turning to our own shores, are recorded the gallant conduct of the trawl boat "Emerald Isle," that saved the crew of the "Eva;" and the pilot that brought Her Majesty's ship "Prince Consort" into safe moorings was a Dublin trawler. Look even at our Dingle fishermen since they became trawlers, the vessels they have aided. The "James Gibbs," with a cargo of 1200 tons of coals, was brought in by them; the crew of the "Christopher Columbus" was saved by them; and no later than the 21st of January last, the barque "Thomas Kellam," from St. John's, with 600 tons of timber, would inevitably have been lost had not one of the Dingle men worked out his craft to save her, and piloted her into Ventry. And are not these men to be encouraged?—our hardiest seamen and best pilots. Look at the ports of Normandy, and see the fine luggers now going to sea, especially from Dieppe, so unlike the old lumbersome boats that sailed from Calais and Boulogne. The French encourage this spirit, to make seamen; and the law compels each boat to carry a certain number of men and boys, whether they require them or not. In consequence of the number of hands they carry, the French boats use much heavier gear in proportion to their tonnage. As a leader or a tripper to the foot rope of the trawl net, they have a heavy chain across the span before the foot rope; and their herring nets, being much heavier, cause great injury to the English boats when they come in contact.

Any legislative restrictions put upon our own trawl boats will not, as Mr. Clay, the member for Kingston-on-Hull, sensibly expressed in the debate on Mr. Fenwick's motion, be effectual:—"If the object of his honorable friend were attained, trawling would not be put a stop to; it would simply be handed over to the foreigner."

In the references that I thought necessary for the more fully explaining the main features connected with the subject, I alluded in

the first part to the peculiar characters of those lines of the east and west coasts where trawling was practised, as the remarks bore immediately on the portion I have now to give, viz., on the habits and seasons of fish. As I have explained the position of the reefs and rocky grounds in the several localities, it is now necessary to give merely an outline of the spawning habits of our sea fish, as the seasons of each kind are given in detail in the Appendix.

All oviparous fish, as turbot, sole, brill, and dory, and the round fish as they are termed—cod, haddock, whiting, ling, and hake—have their peculiar seasons, but each species, with very little variation as to regular periods, on every part of the Irish coast. It is necessary for the due development of the ova after exclusion from the parent fish, that they should be deposited in such places of shelter and security from the action of the sea, and where the depth is such that the effect of light and temperature should aid in the development. Hence the general average depth is under ten fathoms, more generally about three to five fathoms, and even less, according to locality. Turbot and soles are found to spawn in soft sand and mud, where ledges of rock shelter; cod, haddock, and ling, on a rocky or corally bottom; but all these fish so place the ova, that in the recesses of reefs, or on coral beds, adhesion or secure resting may be accomplished, and where the force or action of the tide or surf may not disturb. Cod and haddock deposit their ova on very rough ground, at such depths along the line of coast as, I before said, were necessary for bringing the ova to maturity. As it is shown that these depths vary all round the coast, the rules by which the present boundary lines are framed do not afford the remedies required for the protection of the ova and fry.

In a former paper I mentioned, with regard to Galway Bay, that numbers of young or undersized turbot were taken by the spilliards of the Gleninagh men in the shoals outside of the boundary line, and that quantities of young and spawning fish were taken in Dingle Bay by the line men of Anniscaule.

Near the several reefs along the coast there are generally shallows of mud or sand, or long inlets of sand, as along the line of coast from Balbriggan to the Bay of Dundalk. To those shallows the young fish retreat, and remain until sufficiently mature and strong to seek the grounds of the parent fish. These shallows are generally from two to three fathoms, and shoaler, and where no large trawl boat could interfere, nor on those grounds that I have described as the spawning beds; for no fish deposit spawn on the clear bottom of the deep soundings of any bay or inlet. In Brandon Bay, for instance, where a line is drawn across from Brandon Point to Coosanea, shutting out from trawling an extensive range of clear sandy soundings, within the line of fourteen to ten fathoms, and where outside the boundary line to the Magharees are extensive spawning beds. I could enumerate other cases where a useful system of fishing is prohibited, but where so much injury

is caused by the very people whose modes of fishing it is considered proper to protect.

I would suggest that around the entire coast of Ireland no system of trawling be permitted within the five-fathom line, which would fully protect in all localities the young of every species of ova-bearing fish. The coastguard from station to station could as readily recognise any infringement within that line of soundings as within the present boundary lines.

The serious evils complained of on the coasts of England are the unrestricted use of heavily-leaded seines with small mesh, of small craft with beam trawls, and with pole trawls that work inshore, and which are the real destroyers of spawn and fry; for in very shoal water, and in the sandy or muddy recesses of spawning beds, those little boats readily work. I am aware of the destruction caused by these shore seines, net-waders, and others of that class; for it is known to me that a seine in scarcely a fathom of water drew on shore a large number of very young turbot, and this is practised on the east coast, and also on the west.

From the voluminous evidence given in the Report of the Commissioners of Fisheries for 1836, many valuable opinions may be gleaned. I extract the following, as appearing to be most reliable:—"Cove District—Trawling has increased, and the general opinion is that it has destroyed the spawn. The quantity of fish has diminished; supply is drawn from the *inshore pole trawlers.* The fishermen have complained of trawling by small craft within the harbour at all seasons, by which large quantities of young and useless fish are destroyed which if allowed to remain until the proper season would be productive"—(Mr. J. Smith Barry). "I am informed that trawling in the bays and harbours has increased since the fishery laws have ceased, and I am of opinion that this has tended to diminish much the supply of fish. The quantity of flat fish has diminished by the practice of constant trawling, which is *most inshore.* The supply of fish is exclusively drawn from trawling"—(Sir R. Hagan). I give these merely to show the true effects of inshore trawling by small craft.

In all my experience in the working of the large-class trawl boat in the Bays of Galway, Dingle, Ballinskelligs, and Kenmare, I have never, at any season of the year, seen spawn or fry of any kind of fish taken by the trawl net, with the exception of the fry of those viviparous fish, such as sharks, dog-fish, and rays, that have their young in deep water. It would be an impossibility for those large boats to use the net over those grounds where spawn or fry exist. I distinctly aver that the large trawl boats working in Galway or Dingle Bays would not injure the fisheries of these bays; and that the boundary line (if boundary lines should exist) in Galway Bay is sufficiently and most judiciously drawn. Those who are unacquainted with zoology may deem they are destroying an immensity of young fish when they meet with the several species of dabs (*Platessa microcephala,* and *P. limanda*), the

scald fish or megrim (*Psetta arnoglossa*), which are of small size, and taken in deep water; also the little sole (*Solea lingula*), which is taken in numbers in deep water by the Brixham and Barking trawlers. It is called by them the red sole, and quantities are either thrown overboard, or found lying in the boats. Its general size is four inches. These several fish mentioned may be mistaken for undersized or fry. It is much to be regretted that the poor Claddagh men have not boats and gear equal to fish on the proper grounds, for it is not when the fish come into the shoaler water of the bay that they are in condition to take. I have seen flabby and poor fish in the markets of the Claddagh, like our "Dublin pea cod," the most unwholesome fish on sale; for no unsound or ill-fed meat in a butcher's stall could be worse than those bloated fish, irrespective of the destruction of such large masses of spawn.

In Ballinskelligs Bay, on the coast of Kerry, one of the wildest on the south-west coast, and noted for the numerous wrecks and loss of life, I have never met such materials as described by Mr. Fenwick, from the information afforded to him by the captain of a trawler, and by the North Sea man. With a vessel of eighty tons, having a trawl beam of forty-five feet span, we, in a stiff breeze and swell, towed fast across the bay. In the trawl we had eighteen cwt. of fish, the heaviest take I have ever noted. What a representation, that three tons' weight were taken by this captain of a trawler in one haul! The romancing of such men and of Mr. Crick are not to be credited. The fish taken in Ballinskelligs Bay were splendid turbot, large soles, haddock, hake, dory, and gurnards; also fine plaice. The dory (*Zeus faber*) are particularly fine in the bay. Small-sized scaldfish, which is a deep-water species, were plentiful. The fish were beautifully clean, and many of them lively when freed from the trawl net on deck—not a fin disturbed; for I particularly admired the expanded pectoral fins of the sapphirine gurnard (*Trigla hirundo*), and its vivid colours. Fine specimens of the piper and cuckoo gurnards were also taken, and the *Trigla pini* of the Mediterranean. In Kenmare Bay, haddock, sole, and plaice have been taken out of the trawl net uninjured and lively, and have been transferred to the beautiful fish ponds of Mr. Bland, of Derryquin Castle. In Kenmare I obtained in the trawl a fine specimen of *torpedo*, the *Torpedo nobiliana*, which I examined in a perfect and living state. When first trawling was commenced in Dingle Bay, the opposition by the local fishermen was equally violent as that still shown by the Claddagh. Encouragement to the Dingle men, and showing convincing proofs of the benefits of improved systems of fishing, have so influenced them, that they are all now the strongest advocates for trawling.

Sir Richard Griffith, Bart., who, as Chief Commissioner of Fisheries, presided at an inquiry held at Dingle in January, 1862, on an appeal made by the Dingle men, to rescind the boundary line, saw at once the manifest improvement among the fishermen. I submit a letter, dated the 24th of March last, which proves how beneficial Sir Richard's de-

cision has been. This letter is from one of the most experienced and influential among the Dingle fishermen.*

In the Appendix are given the depositions of two most experienced seamen and masters of trawl boats, employed in the Bay of Dingle, as to the results of trawling, and how little injurious it has been to the fisheries of the Bay. The Dingle men at first avowed that the greatest destruction was caused to spawn, without, like the Galway men, knowing really what spawn was. The Galway men swore that they *observed the eyes of the young fish in the sponge* (*Raphyrus Griffithsii*), and the young state in the *Halichondria panicea;* like the line fisherman at Mullaghmore, in June, 1861, who swore as to *spawn* taken by the trawl, which was nothing but *Ascidia mentula* and Alcyonium. It has been suggested that the trawl net should have very large meshes. Practical men know well that, no matter how large the mesh, the elongation of the mesh in fast drifting will keep in the smallest fish. It was proved before the Royal Commission inquiring into the coast fisheries of England, in December last, that the seines used in the tidal parts of the Esk destroyed an immensity of young fish. Unfortunately the practice is still permitted, the only restriction—the mesh to be altered to the salmon size. I find it an impossibility to condense all these views, therefore I shall briefly allude to the ranges of fish and to the hook boats. So certain and regular are the movements of soles and other fish upon our coast, that each year the trawl boats have their seasons—the north-east grounds, the Isle of Man, and the south coast, off Wexford and Waterford—as the fish approach their beds to spawn, or change their feeding grounds. In Dingle Bay the changes are similar. In January the soles are in deep water off the Wild Bank and Doulas Head—in

---

* "*Dingle, 24th March*, 1864.

"SIR,—As I am aware that you have returned from London, and that you are always anxious to know the state of our fisheries, I beg to let you know that cod and ling are as plenty in our bay this season as they have been for the last ten years; but haddock is scarce, not even in our bay, but all around the western coast. I am proud to say that there is a good feeling between the hook men and the trawlers; all are fishing on the same ground, and are getting large quantities of the finest fish, and in the best condition. The canoes are getting cod and ling, and the trawlers soles, turbot, and britt. It gives me great pleasure to say that I did not hear a single word of dispute between the hook men and the trawlers this year. The trawlers do all in their power to keep from the lines; and if they chance to take away any part of them, which only happened once or twice this year, they pay the canoe men at once for the damage, so that all bad feeling is done away with. The canoe men this season, when they would get a fine day, earned from three to six shillings per day, each man. The trawlers are doing as well this year as they did for the last five years. The large boats are doing well, and I send you a return of a day's fishing of a small boat of eighteen tons.

"Sir, I hope this sufficient to let you see that there is no decrease in our fishing as yet either by the canoes or trawlers. I am sorry to tell you that many of our fishermen are doing but little, in consequence of the small open boats they have, and could not venture out in stormy weather.

"I am Sir, &c.,

"*Wm. Andrews, Esq.*" (Signed) "EUGENE MORIARTY.

February and March, off the Ventry grounds. In April they go inshore and up the bay. After spawning they return again to the Ventry ground; and in autumn, out of the bay, retire into deep water, causing the bay to be regularly fished out; but, fortunately, the next season the same routine goes on as abundantly as ever. Just so in Galway Bay—the early season is off the Murrough. From February, March, and April, they are in the bay, when after they again retire to deep water.

Haddock, that is said to be banished by trawling, is a deep-water fish, and is still abundant on the coasts of Ireland; but, going in shoals, and being a voracious feeder, they change their feeding grounds. According to weather and seasons, they are some years frequent in the bays of the west coast. They were so abundant along the south shores of Dingle Bay, in 1861, that the Dingle canoes brought in large numbers every day. They are still abundant on the grounds north-east of the Skelligs, off Smerwick, and the North Blasket, also off Kinsale and on the Nymph Bank; but the distances are too great for the canoes and the small class hook boats to go for them.* Mr. Austen, at the meeting of the Board of Fisheries at the Custom House, in March last, made a sensible remark, that he did not consider that trawling had banished haddock from Dublin Bay, for they are plentiful on the coast of England, where trawling had been carried on for a hundred years.

I must conclude by observing that fish of all kinds are as plentiful around the coasts of Ireland as ever; but the boats of the hook or line fishermen are only fit for moderate weather and off-shore winds. The herring and the oyster fisheries would occupy very long papers; I must, however, say that I do not coincide with Mr. Mitchell's views as to the mode he describes of the spawning action of the herring. The oyster fisheries are much engaging the attention of the Commissioners and my zealous friend, Mr. Barry. There are great difficulties in settling public

* The drawings represent the points of bearings of Innisnabroe, one of the Blaskets, which form the western bounds of the outer sound of the Great Blasket. It is a safe and clear passage, having sixteen to twenty-one fathoms close in, and twenty-eight fathoms mid-channel. In the course from the southward steering east of the West Blasket, Innisvickillane, (No. 1) represents the very beautiful and singular features of the point, bearing about N. W., remarkable for the almost basaltic appearance, and the perforations caused by disintegration and the action of the sea. The singular forms assumed by this vertical Old Red Sandstone formation are strikingly beautiful, and give very peculiar characters of the Old Red Sandstone of the Dingle beds. A very valuable and able paper was some years since given by Sir Richard Griffith, Bart., at a Meeting of the Royal Geological Society of Ireland, "On the Order of Succession of the Strata of the South of Ireland"—in which he particularly refers to the Upper Silurian series of Ferriter's Cove, and the Old Red Conglomerate, which usually form the base of the Old Red Sandstone or Devonian Series.

No. 2 Drawing is taken in the course from the Tearaght Rock, the point bearing by compass S. E. by S.

The fishing grounds off the Islands particularly N. W. of the Tearaght, and N. E. of Innistooaker, are excellent, with abundance of fine cod and ling; but there are no boats in Dingle Bay equal to keep on those grounds.

and private rights of the beds, hence the few applications for the formation of beds.

Again, with reference to the Claddagh case, Mr. Anthony O'Flaherty and others had well lauded the virtues of the Claddagh, and they have spoken of their poverty, all of which we readily admit, and we feel commiseration for their melancholy hearths. Some here this evening may know of the charming walk from the Hague to the pretty village of Scheveningen; the beach that is so gaily promenaded by happy summer strangers of all nations, and all so animated amid those beautiful walks and elegant houses; but behind are concealed narrow lanes, in which a silent and poverty-stricken population are hidden. These are the brave seamen and fishermen of Scheveningen, a population characterized by all the peculiarities of the Claddagh. They are a race within themselves; poor and free, they own no masters, recognise no authority, and obey no owner. The fisherman and girl of Scheveningen are marked by characteristic honesty and virtue; they love the sea, and they love their *dunes*. Surely, then, those men who so strongly advocated the cause of the poor Claddagh race, at the meeting held in Galway on the 28th of March last—the Dalys, the O'Flahertys, Burkes, Blakes, &c., will not hesitate with approved security to aid these suffering men and their families; and I venture to affirm that the "Trustees for bettering the condition of the Poor of Ireland" will at once give attention to their application. Assistance so given is far more likely to stimulate industry than any government aid or interference,—the surest course being to arouse and direct the fishermen to work upon their own resources independent of all gratuitous relief.

I would now conclude, in reference to the Claddagh, with the words in the memorial addressed by the inhabitants of the town and county of the town of Galway to His Excellency the Earl of Bessborough, in 1846:—"Patient and hardy at sea—a labouring race, whose loyalty is proverbial, whose virtues are their own, and whose faults are in the main attributable to the want of encouragement for their trade, by which so much wealth is annually lost to Ireland."

The Chairman said, the subject of the very able paper which the Society had just heard was of the greatest importance to the community. Having borne testimony in favour of the character of the Dingle fishermen, the Chairman remarked that the question as to whether trawling was destructive to fishing grounds was an open one. If Government should issue any commission of inquiry on the point, he trusted that it would be an effective one.

Mr. Good, the proprietor of a large number of trawlers, addressed the meeting at some length. He said—I have listened with much pleasure and interest to Mr. Andrews's very able paper just read. I believe that the trawling community all round the coast of Great Britain and Ireland owe him a deep debt of gratitude for the manner in which he has advocated their cause, having proved by his great scientific knowledge, together with his thorough practical experience, that deep sea trawl fishing is not attended with the effects

alleged by the hook and line fishermen, as well as other prejudiced and ignorant people, that is, of destroying spawn and young fish. It has been most absurdly and erroneously stated on the occasion of the Royal Commission being appointed in 1863, to inquire into the deep sea and coast fisheries of Great Britain and Ireland, that twenty tons of spawn were taken up per week by each trawl boat, whereas the fact is that three tons of fish per week in the aggregate are rather above than below the average taken by each trawler. I can also speak positively from my own personal and practical experience for the last twenty years, that I have never seen, nor heard of the spawn of, any oviparous fish being taken up by a trawl. The spawn of the different varieties of cuttles fish are frequently taken in soft mud, in the winter and spring months. I have often both seen and heard of the spawn of the common squid (called by the fishermen, scolch, or pound of candles), being mistaken for haddock spawn. The several varieties of oviparous fish are known by ascertained facts to deposit their spawn by instinct in soft, sandy patches, which are protected and sheltered from currents and other influences by rocks and rough bottoms, over which no trawl net could possibly be worked. Proofs may be cited in numbers, to show that the spawn is not injured by trawling: for example, the herrings, which spawn all along our coast, have gone on increasing in the most prodigious quantities for a number of years back, and in fact the herring fishing has never been so prosperous and productive as for the last five or six years back. It is a remarkable fact in evidence, that the very grounds upon which the herrings are taken have been trawled over continually for the last forty years or more, whereas the herrings which have frequented the Killybegs in such very large quantities from time immemorial have entirely deserted that coast for the last eight or nine years, and have not since returned, although no deep sea trawling has ever been carried on there. I may also remark, in like manner, that the haddock which were found in such abundance along the east coast of Scotland appear to have entirely deserted it, though that coast has never been trawled over; they are still taken in large numbers in the deep water of the North Sea by trawlers fishing for the London market; indeed, I may add, that eight-tenths of all the sea fish sent to London and other large English markets are taken exclusively by the trawl. The fish in the Plymouth and Brixham trawling grounds have not fallen off in supply, although trawled over constantly by 800 of the largest class of boats. I fully agree, and hold with Mr. Andrews in his opinion, that most, if not all the mischief done to spawn and young fish is caused by a small class of boats, with beam and pole trawls, and with herring, sprats, and sand-eel seines, which are constantly used at the mouths of rivers and estuaries, and the shallow parts of the bays on different parts of the coast; and I should think his suggestion of drawing a five-fathom line all round the entire coast, and wholly excluding trawling inside that limit, a very admirable one, and would be much more effective in preventing the destruction of the spawn and young fish than the enlarging of the meshes of the small trawl and seine nets, all of which could take up the smallest flat fish, no matter what size the mesh may be. The establishing of a healthy and successful system of trawling at Dingle is entirely due to the labours and exertions of Mr. Andrews, there—many of the Dingle fishermen being now proprietors of good and strong vessels, assisting largely in the supplying of the Dublin market with soles during the winter and spring months, before soles are taken on this coast; they are, as well as good fishermen, expert pilots, which is a matter of great importance on that particular part of the coast, where so many disabled vessels from America fall in, requiring assistance; and these very Dingle men who are now such advocates of trawling were as blindly opposed to it heretofore as the inhabitants of the Claddagh are at the present time, and I am really at a loss to know how the Claddagh men have found so many admirers and sympathizers with them in their blind opposition to trawling. I can well recollect the time when the Rev. Mr. Syng, of Arran, who had a trawler in the bay, was hotly persecuted by them, and had several times a narrow escape of his life. On one occasion several were arrested for their violent conduct to him, and for which they would have been severely punished but for the late Henry Grattan's kind interference on their behalf, and by their pledging themselves never again to interfere with, nor show any hostility to trawlers or trawling. This Mr. Grattan has himself told me: he was at that time after having purchased the Claddagh. I would suggest to the local Galway gentry who are interested in the Claddagh men, and anxious to im-

prove their condition, to assist them, as Mr. Andrews recommends, in getting loans of money from the Society for bettering the Condition of the Poor of Ireland, and thereby enable them to get large boats, with long and deep trains of herring and mackerel nets, and pursue drift net fishing along the coast; and also come round to the Irish Channel in the proper season, and take share of the rich harvest which has been reaped principally for many years by the Cornish and Scotch fishermen in the herring fishery. At present, however, I am happy to state, that a large number of boats belonging to Dublin, Kingstown, Howth, and Skerries, &c., and increasing yearly, have got their full share of it, they being rather more successful even than their Cornish cousins. The English and Scotch boats rarely or never fish in any one place longer than from two to three months, but keep shifting their grounds according to the peculiar season in each place; instead of pursuing this plan, if those men acted like the Claddagh people, and remained constantly in the one bay, I am of opinion their condition would be pretty much the same, and their minds narrowed to the same compass.

Mr. BURKE thought trawling was calculated to denude the coast of fish, and hoped that Government would interpose to restrict it within proper limits at places where it was injurious.

Mr. HICKSON, Q. C., referred to his experience of trawling off the coast of Kerry, and particularly Dingle, and said it was the general opinion of the proprietors that it should not be permitted within the boundaries. The proper grounds for the trawlers to work on should be outside the headlands in deep water. They should not be permitted to fish inside the headlands of Bray Head, at Valentia, or within such headlands as Kerry Head, and Loop Head.

Mr. G. W. MAUNSELL observed that but for trawling fish would not be had cheaply. The objections to it were analogous to those made to the employment of machinery in weaving and other departments of industry, which, though it might injure particular interests, yet was beneficial to the whole community. The answer to a great deal of what was said against trawling was given by facts as to the migrations of fish. Previous to 1799, an immense herring fishery was carried on out of the seaports of Denmark, when suddenly in that year the fishery grounds were deserted by the fish. The fisheries were ruined, and the capital employed in them was turned into other directions; and yet, after some ten years' absence, the fish returned again to the same grounds in as great numbers as they had frequented them before.

MR. THOS. F. BRADY, Secretary to the Commissioners of Fisheries, said,—I think not only this Society, but society at large, ought to feel deeply indebted to the learned lecturer for his admirable and highly interesting paper this evening, and for the careful study he has given this most important subject. I can bear testimony to the truth of several of the statements made, having trawled in several bays in Ireland, including Bantry, Dingle, Galway and Dublin, and have never yet seen that destruction of spawn or young fish which is attributed to trawling; and I never saw spawn taken up. The statement made that the fishermen at Dingle were working harmoniously together is particularly gratifying to me, as I was, under Sir Richard Griffith, the humble instrument of having the restriction against trawling in that bay removed, after carefully examining the bay practically for several days previously, and trawling therein; and the evidence on which that change was made was irresistible, all the fishermen of every class having had ample opportunities of giving their testimony before Sir Richard Griffith. Statements have been made that trawling is injuring the fisheries of the country; that the men and boats are dying out; but the fact is, there is more fish going into the London market now than ten years past; and the boats round the coast of Ireland, in the important fishing stations, are increasing in number, and better in class; this is evidence against the statements made. With respect to the oyster fisheries of the country, it may not be generally known that we have at present a very large export trade to England and France, of young oysters, to lay down on other beds. Off the coast of the counties of Wicklow and Wexford, there are ranges of oyster beds about twenty miles in length, and in breadth from one to three and four miles wide; and the trade in this place this year

has been greater than can almost be conceived; carried on by English and French buyers who, I am informed, on many occasions paid in Arklow alone as much as £1000 to £1200, and £1400 a week, for oysters for export; and from Wexford port alone were shipped, during the past season, no less a quantity than 25,000 tons to England and France. Few people know we have so large a trade near us. At present there are fifteen Jersey boats working on these beds; between twenty-five and thirty tons is the average weekly amount sent by the trading steamer to England, commencing in September: March, April, and May are the principal months for the export. A new bed, with very large and fine oysters, has been discovered off this coast this season. The price has greatly increased within the last four years. I have only to say, I think Mr. Andrews' papers exceedingly important and valuable, and that we should feel much indebted to him for his researches on this very important subject.

Mr. Andrews replied, saying that he could not conceive upon what grounds Mr. Burke entered into such views of the Fisheries as he had expressed. Mr. Burke appeared wholly unacquainted with any state of our Fisheries, or the best means for their promotion and protection; and with reference to Mr. Hickson's representations, he considered he was misinformed as to the opinions entertained by the proprietors. Six hours in a trawler outside Bray Head, at Valentia, or outside the bearings of Kerry and Loop Heads, would afford Mr. Hickson an ample, and not to him a very desirable, test of such fishing grounds as those to which he proposed to restrict the trawlers. He (Mr. Andrews) said that he felt extremely gratified at the manner in which his statements had been received by the Society.

A vote of thanks was proposed to him for his able communication, which was carried by acclamation, and the Society adjourned.

APPENDIX.

SPAWNING PERIODS OF FISH.

The following statement is merely in relation to those fish that are taken in the trawls, and to those that are generally sought for by the line fishermen. A future publication will embrace more fully the habits and seasons of the several kinds of sea fish that are known to frequent the coasts of Ireland.

Conger vulgaris, the conger eel—At the entrance of Dingle Bay, in deep water, congers of large size are taken by the line from April to the end of summer. The conger spawns in December and January, and the fry during the summer and autumn are frequently found among the shoal reefs of rocks in the bay. The conger destroys large numbers of the young of the lobster and crab. It is valuable as bait for the long lines.

Ammodytes tobianus, sand eel.—In great abundance on the west coast: on some parts of the coast, raking on the shingly beds for sand eels at low water affords great excitement. It is a favourite food of the turbot, and in many of the shoal sandy inlets frequented by the sand eel is the feeding ground of the young of the turbot and the brill.

Belone vulgaris, gar fish.—These fish frequent deep water; but early in summer they come into the shallow bays and inlets to spawn. They are in fine condition throughout the summer, and considerable numbers of large size can be taken in Dingle Harbour with the seine; they are excellent eating, but are only valued and taken for bait.

Morrhua vulgaris, common cod.—Is a deep water species, and only visits or approaches the shoaler grounds of the coast during the winter and spring months to spawn, where it is taken in great numbers by the line fishermen, and not unfrequently in the trawls. Its condition at that season is very inferior. The cod fish spawn on rocky and corally ground from December to February, close in with the land. The fish quickly recover from the spawning state, and retire into deep water, where they remain throughout the summer

until the end of autumn. It is in the summer that they are in the best perfection for the table or for curing. The same may be applied to the haddock and the ling. Cod fish feed voraciously on molluscous animals, crustacea, and the squid, *Loligo vulgaris*, which abound in the gravelly and shelly soundings where the fish feed during the summer months. Large quantities of the prawn, *Palæmon serratus*, and *Pandalus annulicornis*, have been found in the stomach of the cod, taken in eighty fathoms.

Morrhua æglefinus, the haddock, is of exceedingly wandering habits. It spawns during the spring months, generally from January to the end of February, on the west coast, and as late as March on the east coast. It then approaches the shore, and spawns on very rough or corally ground, the average depth being about five fathoms; after spawning it retires into deep water off the coast, and feeds on coarse sandy or shelly grounds. It is throughout the summer and autumn in fine condition. Haddock not unfrequently, as they are generally in numbers together, come into soundings of ten to thirty fathoms, if the feeding grounds are good. They are then taken in large quantities both by the hand line and spilliards. At other times they altogether desert their usual haunts, probably seeking more abundant feeding grounds. On most of the deep water banks of soundings around our coast haddock are still plentiful, particularly on the ranges of the Nymph Bank. The boats on the south and west coasts are at present too small to keep the sea and to fish with lines off the coast, where the haddock and other kinds of superior round fish are to be found. Thus, for the same season, the

Brosmius vulgaris, the torsk or tusk, is rarely taken, although abundant in deep water soundings off the western coasts. It is an excellent fish, and has the habits of the cod fish. In the Feroe Islands the fishermen only occasionally take them when cod fishing, but after a gale of wind and heavy sea on shore, numbers are thrown on the beach. This proves the quantity in deep water off the islands. In eighty fathoms off the Tearaght Rock, a number in fine condition were taken in the month of July.

The best feeding grounds of the haddock are on coarse gravelly and shelly ground; and the North Sea men know at once by the soundings the proper ground to find them on. In Kenmare, when trying the soundings, we met a fine bottom of shelly gravel off Ardgroom Harbour in twenty-two fathoms. Our long lines were set, and in some hours afterwards we had a fine take of large haddock. The bait used was the *Tapes decussata*, called in Kenmare Bay, *budherees*. A number of small boats were hand-line fishing off Kilmachalouge Harbour, and got but few fish.

Merlangus vulgaris, the whiting, spawns in February and March. In the bays of St. Finian and Ballinskelligs, off the coast of Kerry, and in Galway Bay, they are very fine, and are taken in fifteen fathoms water in great number.

Merlangus carbonarius, the coal fish, is taken in considerable quantities off the Arran Isles, and are very fine and large on the south coast. They are destructive fish to the herring fry and sprats. Their condition is the best in the winter months, before they spawn in February and March.

Merlangus pollachius, the pollack, are in great numbers among the rocky ledges of the Blasket Islands; they spawn in December and January, and are in fine condition throughout the summer. This fish, with the hake,

Merlucius vulgaris, are taken in large numbers with hand lines. The hake is a valuable fish, both in the fresh and in the cured state, to the poorer classes; westward of Kinsale, and the entire range of the south-west and west coasts, the hake is abundant, and during the summer and autumn months are taken in large numbers with hand lines on the same ground the trawlers work. The hake come into the bays in large sculls in pursuit of herrings. They are very destructive to the herring; and also the blue shark, *Carcharias glaucus*, which follow the herrings. Large numbers of hake are taken in the trawl, particularly in the spring months, when they approach the shore to spawn; like the cod, ling, and haddock, the hake spawn on rough ground.

Platessa vulgaris, the plaice, is exceedingly fine in Dingle Bay, and on several parts of the west coast. Their goodness depends much upon the soundings, where the trawls work, as is the case with most of the Pleuronectidæ. Dingle plaice, during the summer months, are in the finest condition, and are equal to the plaice taken on the Diamond ground on the coast of Sussex; they are also fine at the entrance of Galway bay. On the west

coast they are on the spawning grounds in February, March and April. They spawn in shoal water on a muddy or sandy bottom, protected by ledges and reefs.

In May, and throughout the summer, they are fine, and are abundantly taken in the trawls. I have seen plaice taken on the Dublin coast, in mature spawning condition, in January. When plaice, the Mary sole, and dabs appear in numbers on the trawling grounds, the soles have generally moved into deep water, chiefly in the months of July, August and September.

Platessa microcephala, the lemon dab or Mary sole.

Platessa limanda, the common dak.

Zeugopterus megastomus, the whiff, are taken throughout the winter and summer months in the trawls, and are valuable to the line fishers for bait, and also for baiting the lobster pots. These several species spawn early in summer, in similar localities to the plaice, chiefly in muddy and sandy inlets.

Psetta maximus, the turbot.

P. rhombus, the brill, are very fine and abundant off the west coast. Turbot of great size are taken in large quantities by the canoes in the Blasket sounds; south of the Great Island, and on the Wild Bank, from May throughout the summer, and during the spring and summer months in the trawls. In every sandy bay, and on the sandy soundings along the entire range of the west coast, turbot are fine and abundant. They are of large size at the entrance of the Shannon, and are taken in the trawls in the month of August. on the north side of Galway Bay. Turbot and brill are found in mature spawning condition in the month of April. They resort to sandy inlets to spawn, where the grounds are well protected by rocky reefs. The fry remain during the summer and following winter in very shoal water until their growth strengthens them to move into deep water; the favourite food is the *Acera bullata*.

Solea vulgaris, the sole. Soles are remarkable for their size and superior condition on the west coast. They approach the shoaler soundings of the coast to spawn during March and April, on the west coast. They are in full spawning condition on the east coast in April. Soles are in fine marketable condition previous to leaving the feeding grounds, to go into the shoal and muddy inlets to spawn. After depositing the ova, they quickly recover their condition, and move from the shoals to their feeding grounds again; during the summer and autumn they keep more in the deep water. The fry remain in shoal and sheltered inlets, where the trawl net of the large boats cannot be used.

All oviparous fish, as the turbot, soles, cod, ling, and haddock, very quickly recover their condition from the spawning state, and return to their usual feeding haunts. No systems of fishing are more injurious to the spawning resorts of the fish and the young fry than the unlimited use of shore nets, and the practice of net wading, and also the setting of spilliards in shoal water, during the spawning season.

The different species of gurnards are taken in numbers in the trawls, and by hand lines. Several of the species spawn twice in the year. In summer and autumn, the grey gurnard, *Trigla gurnardus*, and the sea bream, *Pagellus centrodontus*, sometimes give a great harvest to the small shore boats.

Zeus faber, the dory. This delicious fish is very frequently taken in the trawl, and is of large size, in Ballinskellig bay. I have seen it of ten pounds' weight. The dory is a ground-feeding fish, and spawns in early summer in three fathom water in the sandy recesses, where the ova can be protected. In the summer and autumn months it is in fine condition.

A singular fact with regard to the distribution of fish is, that the angler or frog fish, *Lophius piscatorius*, most occurs on the east coast. The angel or monk fish, *Squatina angelus*, is the more frequent on the west coast. These are ground-feeding fish of large size, very voracious, and destroy an immense quantity of young fish, particularly of flat fish. They are frequently captured by the trawl, but are rarely taken by the line.

Rays and dogfish, and also the young, are taken in numbers with trawls—among them,

Raia oxyrhyncus, the sharp nosed rays;
—— *maculata*, the white skate;
—— *clavata*, the thornback;

are very numerous in Dingle, Galway, and Kenmare Bay, and in the Shannon. The fins of the rays are delicious eating.

In this concise review I have merely alluded to the more useful and marketable fish taken by the trawls, and it is quite clear that the varied seasons of spawning should not impose restrictions on that system of fishing; for the mature spawning state of the several kinds of fish, they invariably retreat to such shallows and soundings, where no large trawls could work, and where the ova and fry so far remain in security.

If any decision should be aimed at as to close or fence months, by placing restrictions during the spawning seasons, all modes of inshore fishing, with nets, lines, or dredges, should be strictly prohibited.

It would be very desirable to prohibit all systems of trawling (except for scientific objects) from June to November. This would on most parts of the coast prevent interference with the herring fishery, and with summer and autumn hake fishing. It would also have the tendency to direct the trawling men to turn their labours to the herring fishery, and also to line fishing in deep water.

Those who are unacquainted with the fisheries, or of the states of those of the coasts of Ireland, and of the present systems of fishing, are always recommending attention to be directed to the French fisheries, and to the adoption of their modes. Now, the coast fisheries of France have been seriously injured by the unrestricted use of shore nets, seines, and ponderous drag nets. The latter engines largely supply the Paris markets, and are the means of obtaining the red mullet, *Mullus surmuletus*. This drag net, which is of enormous dimensions, is termed the *chalut*. It is fastened between two large and strong boats, and is so destructive in its operation, that it sweeps every thing before it. By a return dated Sptember, 1862, there were at Dunkirk sixty fishing boats using this net; eighty-four at Calais; one hundred at Boulogne; fifty-three at Tréport; twenty at St. Valléry-sur-Somme; nineteen at Dieppe; fifteen at Port-en-Bessin, and 109 at Tronville. These are exclusively employed in supplying the Paris markets. The consumption of fish in Paris is so large that, in 1860, the octroi of the capital cleared 1,027,920 f. By the time the sea fish are disposed of at the Halles of Paris, their cost is much increased by charges of the octroi, the *écourèur*, at the fishing stations, package and conveyance, and the percentage paid to the *facteurs à la criée*, or market auctioneers.

FITTING OUT OF TRAWLER, LAUNCHED JUNE, 1862.

	Feet.	Inches.
Extreme length, ...	67	8
Extreme breadth, ...	16	6
Depth in hold, ...	10	0

Tonnage, builders' measure, $65\frac{1}{9}\frac{1}{4}$ tons; draws $11\frac{1}{2}$ ft. water.

Keel of British elm; stern post and entire of frame, and deck, beams, &c., of Irish oak. Outside planking:—bottom of rock elm, $2\frac{1}{2}$ in. thick; bilges, 3 in. thick; light-water mark to gunwale, of morah, $2\frac{1}{2}$ in. thick; shear-streak, of African teak, $2\frac{1}{2}$ in. thick; and deck of pitch pine. The entire vessel, including deck, fastened with galvanized bolts.

Two crab winches on deck for working the fishing gear, and a patent windlass for working the chain and anchor. Mast of Polish red pine, 56 ft. long, 15 in. diameter at deck, and 13 in, at trussels, 9 in. at masthead. The mast in wake of jaws of gaff is whelped with morah and African teak.

	Feet Long.	Inches Diam.
Main boom, . . .	45	10
Main gaff, . . .	30	7
Bowsprit, . . .	36	12

Shrouds of 7 in. rope, and lignum vitæ dead eyes. Stay of galvanized wire rope, $5\frac{1}{2}$ in. in circumference. All running rigging, white Manilla rope; lanyards of Riga hemp, tarred.

Sails, of best material:—

Mainsail, ...	260	yds of	No. 0.
Large gaff topsail, .	100	"	" 5.
Small working ditto,	60	"	" 1.
Big jib, ...	100	"	" 5.
Second ditto, . . .	80	"	" 4.
Third ditto, . . .	60	"	" 1.
Small third ditto, .	42	"	" 1.
Storm ditto, . . .	26	"	" 0.
Working foresail, .	60	"	" 1.
Large foresail, . .	90	"	" 5.
	878 yds.		

Of full-bleached, all long flax and East Coker canvass. The cost made up, including bolt-rope, points, thimbles, &c., 2*s.* per yard.

Trawling Gear, &c.—Trawling warps, 170 fathoms of 6 in. tarred Manilla. Bridles, 36 fathoms of $5\frac{1}{2}$ in. Beam-rope, 20 fathoms of $4\frac{3}{4}$ in. Two foot-ropes for trawls, 36 fathoms of 8 in. Manilla. Length of beam for trawl, 45 ft. Weight of trawl head, or iron, 3 cwt. Two trawl nets, 80 ft. long, and 45 ft. spread, weighing, when tarred, about 4 cwt. Value of trawl gear, £70.

Ground Tackle.—One rope cable of 75 fathoms, $6\frac{1}{2}$ in. tarred Manilla 4 strand rope. One chain cable of $\frac{7}{8}$ in. diameter of Admiralty test, and 70 fathoms long. Four anchors, varying in size from 1 cwt. to 4 cwt. Value of ground tackle, £50.

Ballast, exclusively of square pig iron, value £120, and exclusive of metal step of $2\frac{1}{2}$ tons.

When this vessel was ready for sea, with all her necessary stores, her value would reach £1100.

DEPOSITION OF EDWARD REILLY, MASTER OF THE "LORD NELSON" TRAWLING CUTTER, OF EIGHTY TONS.

Is a native of Dublin; has been at sea more than twenty years; three years master of the "Lord Nelson;" during that time in Dingle, the Shannon, and round that coast; knows the fishing ground well; has sounded the entire Bay of Dingle, as well the parts fished as the parts that could not be fished, the ground being foul, rocky, and broken ground, where the boundary line against trawling had been drawn, including parts having 16, 18, 20, and 24 fathoms; never fished further to the east than Anniscaule River—never to Castlemaine Bay; during the winter months south and west winds generally prevail; this would prevent fishing outside the line; trawling can only be on a sandy or clear bottom; trawling up as far as Anniscaule could not injure the spawn, because fish spawn on broken ground, where the trawl could not work; never saw spawn taken up by the trawl; if it had occurred in any quantity, must have seen it; the fishery had increased since trawling began; trawling could not injure the herring-fishing, as the trawl is only in those bays worked by day; could not trawl only by day, so as to see the headlands, to be enabled to avoid rocks and shoals in the bay; could not trawl far to the westward, on account of deep water of the west coast, and heavy seas, and only in moderate weather; with southerly or westerly winds could not work the boats outside the bay; has been frequently ten days in it without getting out; has been on Dingle twenty years; since in a coasting vessel; knows Captain Sterne, Inspecting Commander of the Coast Guard; never saw him in a boat at any time; Captain Sterne sent to me with regard to the boundary line; my opinion was, that it would not interfere much with [meaning] my boat of 80 tons, but it has since been found materially to interfere with the fishing of the smaller boats; the summer fishing is the best up the bay; never at any time saw the fry of fish taken.

DEPOSITION OF PATRICK TOITE, MASTER OF THE TRAWLING CUTTER "DRUID," OF FORTY-FOUR TONS.

Is a native of Kingstown; has been at sea eighteen years,—nearly all that time engaged in fishing; knows Dingle Bay, has been there three years; has examined the soundings in the bay almost every day whilst fishing; knows the parts that can be fished with trawl nets, and the parts that cannot, by reason of the ground being foul and rocky; from his examination and experience considers that fish can only spawn in rocky places where there are small, sandy bottoms—they are thus protected from the sweep of the tide; trawls could not work in those places; never took up spawn upon the sandy bottoms, where the trawls can work; if it was there, must have seen it; always prefers a pure sandy bank for fishing on, or else the edge of a bank of mud and sand; it would not be possible, for these reasons, and considering the mode in which the boats work, to injure or destroy spawn; trawling has not injured the spilliard fishing, or long line fishing; on the contrary, line fishing has much increased, and more successful; the fishermen generally fish in shoal water, and on rough or corally ground; the boundary line has seriously injured trawling in the bay; during the winter months the trawl boats could not stand out to the mouth of the bay with the prevailing south-west winds; knows Captain Sterne and the Coast Guard; never saw them in the bay; shutting up the bay has injured the fishing, and has not increased the spawning; the round fish crowd on the grounds to feed where the trawl has worked, and the line fishermen have their best takes of fish on the same ground; when they first commenced trawling, would sometimes take twenty, thirty, or forty hake in a haul; they have since increased to 300 in a haul; trawling cannot injure the herring fishing, for when the hake are plentiful, herrings are always in abundance; the Dingle fishermen have only the means of fishing for herrings in bays and inlets, but never in deep water; the refuse fish, thrown away by the trawls, are used by the line men for bait, and in winter they can obtain bait in no other way for their long lines; there are very few fishermen in Anniscaule—they only go out of an odd day—they are badly found in boats and gear; the trawlers are very cautious in running foul of the fishermen's lines, as it would delay the boat; if they do damage to the lines, it is owing to their not being properly buoyed; the damaged lines are always paid for.

XXVI.—*On Flax, and the Practicability of extending its Cultivation in Ireland; together with Directions for the Proper Management of that Crop.* By EDMUND W. DAVY, M. B., M. R. I. A., &c., Professor of Agriculture and Agricultural Chemistry to the Royal Dublin Society.

[Read February 15, 1864.]

NOTWITHSTANDING that the extension of the cultivation of Flax in this country has from time to time been strongly advocated, it is much to be regretted that till recently its culture has been almost entirely confined to the North of Ireland, where, as is well known, that plant has been successfully cultivated for a long period.

Several circumstances, however, occurring recently—such as the failure in the supply of cotton, owing to the protracted war in America; the low prices and unremunerative returns from our cereal and other usual farm crops, consequent in a great measure on a succession of bad seasons; and the great emigration which has recently taken place from our shores—have united in a remarkable manner to force on us the importance of extending the growth of a crop like Flax, which is a plant that is not injured to the same extent by excessive rains, and

different atmospheric influences as our cereal and other ordinary crops; gives much agricultural and industrial employment; and, above all, the cultivation of which, and the subsequent manufacture of its fibre, have conduced so much to the prosperity of the North of Ireland, and of those districts in other countries where it has been extensively grown and manufactured. Consequently, were this plant in more extensive cultivation in all parts of our island, we might reasonably hope in some degree to arrest the tide of emigration now taking place from this country, by being able to give our poorer fellow-countrymen more constant employment, and offer them a more adequate remuneration for their labour than they now obtain in so many instances,—thus enabling them to support their families in some degree of comfort at home. So general is this feeling just now, and so much has the attention of the public been of late engaged with this subject, that we can scarcely take up a number of any of our agricultural, or even daily papers, for some months back, without meeting either an article on this subject, or an account of a meeting held somewhere, for the purpose of promoting the growth of Flax in Ireland.

As this subject appears to be now engaging so much public attention, the present Paper, containing the history of Flax from the earliest times down to the present day, and the most important points to be known as to the character and proper cultivation of that plant, and its subsequent treatment for the production of fibre, as well as different facts which show the practicability and advantages of extending the growth of Flax in this country, will not, I trust, be unacceptable to those intending themselves to introduce that plant amongst their other agricultural crops, or who wish to encourage others in doing so; in addition to which, considerable interest is attached to the Flax plant, whether we regard the antiquity and extent of its cultivation, or the many important purposes to which mankind have applied its fibre, from a very remote period, as well as the number of useful applications made of different portions and products of this plant in more recent times.

THE EARLY HISTORY OF FLAX.

In point of antiquity, there are few plants, and those only used for food, that can take precedence of Flax; for we find frequent allusion made to it both in its growing and manufactured state as linen, in the early Books of the Old Testament, which are, as is well known, amongst the most ancient records in existence.

It seems probable that Egypt was the native country of the Flax plant, or at least that there its cultivation first attained a degree of perfection for which it has been celebrated from the remotest periods down even to the present time; and the extent to which it was cultivated in that country from the earliest periods may be inferred from the Book of Exodus, where the mention made of it would appear to show that it was then one of the most important crops of the Egyptians; and, consequently, when the Almighty inflicted the plagues on the land of Egypt, this crop was one of those injured or destroyed by the hail; for

we read in the ninth chapter and thirty-first verse, that "the Flax and barley were smitten,"—showing, by its being mentioned along with that important cereal, the value which was attached at that time to the Flax crop by the Egyptians.

It would appear also, from the First Book of Kings, tenth chapter and twenty-eighth verse, where we are told that Solomon brought out of Egypt *linen yarn*, that they had considerable traffic with the people of other countries in that article.

From Herodotus also, the oldest of profane historians, we learn that Egypt was the great emporium or market for the Flax trade: and the high estimation in which the Flax plant was held by the people of Egypt may also be inferred from the fact that we find the plant itself, or the preparation of its fibre, represented on many of their monuments; and in their mummies the microscope has shown that the clothes in which they rolled or enveloped their embalmed dead some 1200 years before the Christian era were made of the fibre of the Flax plant.

The Greeks appear to have been well acquainted with Flax and the preparation of its fibre; for we find *linen* mentioned by Homer and other early Greek writers. And as to the Romans, we have abundant evidence in the works of their different historians, and writers on rural economy, that this plant was extensively cultivated by that people.

Though Flax and its cultivation are referred to by the several Roman writers on agriculture, Pliny seems to be the only one of them that enters minutely into detail as to the growth and subsequent treatment of that crop, which appear to have been conducted pretty much in the same manner as at the present time. Amongst other interesting observations which he makes in reference to this plant, he states that the Flax of Cumæ, in Campania (which was much esteemed on account of the fineness and toughness of its fibre for the manufacture of nets used in fishing and fowling), was employed in the making of toils or hunting nets for catching wild boars, and that* he has seen some of these nets of such a degree of fineness as to allow of their being passed, together with their ropes, through the ring of a man's finger,—a single individual being able to carry as many of such nets as would surround the hunting ground; this, he further observes, is not so very surprising as that each of the cords of such nets should be composed of 150 threads.

Such network appears to have been used in the manufacture of armour long before that time by the Egyptians; for Herodotus speaks of a curiously made *linen corslet*, preserved in the Temple of Minerva at Lindus, in the Isle of Rhodes, which originally belonged to Amassis, one of the kings of Egypt, 600 years B.C. Curious enough, in Pliny's time, a portion of this same corslet, which was made of a sort of network, each thread or strand of which consisted of the enormous number of 365 fine threads, was exhibited in Rome at the time he wrote,

* Plin. Nat. Hist., lib. xix., cap. 1.

as a specimen of strength and fineness of fibre, as well as of skill in the preparation and spinning of thread.

Much as we may have improved in different mechanical appliances for the separation and manufacture of Flax fibre, there appears to be nothing in modern times that can be compared with the fineness, strength, and complexity of the thread used in the making of the nets and corslet just referred to.

During the dark or middle ages which succeeded the fall of the Roman Empire, the absence of all agricultural records leaves a blank in the history of Flax till about the end of the twelfth century, when we learn from different documents relating to that period, that Flax was grown to a considerable extent in England; being, as it is supposed, introduced into Britain some time after the Norman Conquest, as it is not enumerated amongst the titheable articles of that period; and it was not till the year 1175 that Flax and hemp were included, by the Council of Westminster, amongst those productions from which the clergy were to receive their dues.

As the country became less disturbed by civil wars, more attention was devoted to agriculture and the useful arts; and with the consequent advance of civilization, the manufacture and employment of linen became more general. The importance which was subsequently attached to the growth of Flax in England is shown by the different Acts of Parliament which were passed enforcing its cultivation: thus, in 1532, during the reign of Henry VIII., an Act was passed obliging each person occupying land fit for tillage to sow at least one rood of Flax for every sixty acres of such land in his possession. This quantity was subsequently increased to one acre in 1562, during the reign of Elizabeth, and the provisions of the Act enforced under a severe penalty.

With a view of encouraging the growth of Flax in England as much as possible, we find that in the year 1691, during the reign of William and Mary, an Act was passed, fixing the tithe on Flax as low as four shillings per acre; and later, in the reign of Queen Anne (1713), a bounty of one penny per ell on home-made sailcloth was given, as an encouragement to that manufacture.

THE INTRODUCTION AND CULTIVATION OF FLAX IN IRELAND.

We now pass to our own country, with which we are more particularly interested, and proceed to very briefly trace the history of the Flax plant from the earliest records we have of its being cultivated there down to the present time.

At what period Flax was first grown in Ireland there is no means of determining; it appears, however, that it must have been known in that country from a very remote period; for in an ancient Irish manuscript, written 200 years before the Christian era, the shield of a great warrior mentioned in it is described as being made of alternate layers of linen and leather; and in the thirteenth century we read of the Irish chieftains and their soldiers wearing saffron-coloured garments, which are supposed to have been made of linen; and it is therefore probable

that Flax was cultivated, and linen manufactured from it to some extent in Ireland, from the earliest times.

But, though the growth of Flax gradually extended in this country, as well as in England, from the great encouragements given to it by the State, it did not acquire any degree of national importance till the close of the seventeenth century, when the linen trade received a great impulse by the revocation of the Edict of Nantes, by which act, in 1685, Louis XIV. drove out of France more than 50,000 of the most industrious and intelligent of his subjects, many of whom, well skilled in the manufacture of linen, settled in this country, as well as in England, where they introduced many improvements in that branch of industry from France and the Low Countries, where at this time the making of linen had been brought to considerable perfection.

This was more especially the case with M. Louis Crommelin, who after the repeal of that edict fled from France (in 1699), accompanied by a number of refugees, who, coming to this country, settled in the neighbourhood of Lisburn, near Belfast; and being acquainted with the best methods then known in France of growing and manufacturing Flax, imparted that knowledge to the people of the district in which they came to reside, and this information was afterwards extended to other parts of the country; and to that circumstance we may fairly attribute the reason why Flax has been grown to a greater extent and with more success in the province of Ulster than in any other part of Ireland.

Shortly after the period just referred to, the Irish Parliament confirmed the establishment of the linen trade in Ulster; and a board of trustees was appointed in 1711 to encourage and extend this rising manufacture; and with a view to increase the demand for, and consumption of, linen, the Duke of Ormonde, whilst holding here the office of Lord Lieutenant, directed that linen scarfs and hatbands should be worn at funerals—a custom, as is well known, still prevailing.

Soon after this period, the manufacture of linen seems to have steadily progressed, and different improvements were made by the application of new mechanical contrivances, as well as by the use of various chemical agents in the preparation and bleaching of the fibre and the manufactured linen. Thus, Dr. James Fergusson, of Belfast, was awarded in 1764 a sum of £300 by the Linen Board, for the successful application of lime in the bleaching of linen, as a substitute for the excreta of animals, which, as an alkaline reagent, was commonly employed in that process; and the same gentleman subsequently, in 1770, introduced the use of sulphuric acid instead of buttermilk, which was previously in general use, as an acid, in the bleaching process.

Various other improvements were rapidly introduced after this time, amongst which were the employment of potash in the alkaline ley used for boiling the yarns and cloth; and the still greater improvement in the application of chloride of lime as a bleaching agent, which has done so much in facilitating the bleaching of linen, as well as of many other useful substances.

It would be tedious to trace still further the advancement of this manufacture in Ireland, and to show how, step by step, this country became celebrated for its linens: suffice it to say, that the Linen Hall in Dublin soon became the great depôt to which linens were sent by the different manufacturers of this country, and that there merchants and traders from various parts repaired for the purchase of such manufactures.

The means of transport, however, becoming more easy by the construction of new roads throughout the country, and still more so by the application of steam to locomotive and marine travelling, the manufacturers in the North of Ireland soon found it more to their advantage to send their goods direct from Belfast across the Channel to Liverpool, Manchester, or London, where they had agents to dispose of them, than to send them up to Dublin; and thus the Linen Hall, which was in former days a place of much commercial importance, has sunk into its present deserted condition; and a considerable portion of it has been converted into a barrack, or devoted to other purposes very foreign to those for which it was originally intended.

In 1828, the Government, considering that the linen trade in Ireland was sufficiently established to be independent of public support, dissolved, by the consent of Parliament, the Linen Board; and all further grants for the promotion of the linen manufacture were suspended. After this for a time the cultivation of Flax in Ireland seems to have declined, no doubt from the want of some society like the Linen Board to watch over and encourage the linen manufacture. In 1841, however, the Belfast Flax Improvement Society was formed, which gave new impulse to the cultivation and manufacture of Flax, and originated many improvements. Amongst other means that were taken for the carrying out of the objects of their Society, they brought over from Belgium persons skilled in the culture of Flax, to instruct our people; and finding afterwards that this was not sufficient for the purpose intended, they selected a number of intelligent young men, who were sent to Belgium to be instructed in the Flemish mode of cultivating and preparing Flax; and the result of this excellent proceeding was soon apparent in the increased quantity and improved quality of the Flax produced in the North of Ireland. The Royal Dublin Society, too, which has always been ready to encourage any project having for its object the promotion of the agricultural and industrial prosperity of this country, by its offering prizes at its triennial and other exhibitions, for the best Irish linens, has aided in no small degree to advance this important manufacture.

The formation of the Belfast Flax Improvement Society was soon followed by others, which gave increased stimulus to Flax culture, especially the North-Eastern Agricultural Association for Promoting the Growth of Irish Flax, which took the place of the former society, and is now actively promoting the objects of that association.

But, though the growing of Flax and the manufacture of linen have (owing to the encouragement of those Societies and other circumstances) been flourishing in the North of Ireland, the culture of that plant in

other parts of this country has been hitherto either very limited or entirely neglected; and little or no attempt, except in a few instances, has been made to introduce Flax as a regular crop amongst our agricultural rotations. Such a desirable end, it is scarcely necessary to say, is the object of the present great Flax movement, which, if carried out, as there is no doubt it will be, is calculated to effect much good for our people and country.

THE BOTANICAL RELATIONS AND THE GENERAL CHARACTERS OF THE FLAX PLANT.

The common Flax plant (the *Linum usitatissimum*) is a delicate-looking plant, which usually attains a height of about two feet, but may, under very favourable circumstances, grow much higher. It has a slender rounded stem, which is but slightly branched, and is thinly covered with narrow glaucous three-ribbed leaves, and bears at its summit a few elegant pale-blue shining flowers.

The fruit is a globular cartilaginous capsule, splitting when fully ripe into ten boot-shaped valves, each containing a single seed; these seeds which are brown, shining and oval, constitute the well-know linseed.

This plant, which is the most characteristic and important species of the genus *Linum*, belongs to the Natural Order of *Lineæ*, or *Linaceæ* (the Flaxworts) which are remarkable for the tenacity of their fibre, the mucilaginous character of their seed, and, as a general rule, the beauty of their flowers. This Family, according to Dr. Lindley, contains three genera, and about ninety species, which are irregularly distributed over the greater part of our globe.

The principal stations of this Order of plants are—Europe, North Africa, and North and South America; though individual species are to be met with in India, New Zealand, Australia, and other countries. As to the Flax plant itself, it is remarkable for the great range of climate in which it may be grown. Thus, in Europe, we find it cultivated in Norway, Sweden, and Russia, as far north as 64° and 65° north latitude, and from this extending to the shores of the Mediterranean. It is grown also in North Africa, the temperate parts of Asia, on the east side of North America, and in other districts, in more or less quantity. But the chief Flax-growing districts are the three following, viz.:—First, those portions of Russia and Prussia lying south-east of the Baltic, from which there is an exceedingly large exportation by Riga, Revel, Libau, Pernau, and St. Petersburgh, to a great portion of Northern Europe, as well as to England and this country, both as Flax and Flaxseed. The second district is that of Belgium, Holland, and part of France, from which, especially from Belgium, we get the finer kinds of Flax fibre,—the coarser being principally obtained from Russia. The third, is that of Egypt, which chiefly supplies the countries bordering on the Mediterranean.

The great capability of the Flax plant to grow in such very opposite climates as to temperature may be partly accounted for, when we

recollect that it is an annual of very rapid growth, which soon completes the period of its existence; so that it can be cultivated in the summer in the colder climates, and in the winter in the hotter: thus, for example, in Egypt it is sown in December or January in the fields just quitted by the Nile, and is harvested in April or May; whilst with us, and in colder climates, it is sown in April or May, and gathered in August or September; and by this arrangement the differences of temperature during the period of its growth are not so very great, comparatively speaking, between the northern parts of Europe where flax is grown and that of Egypt.

This power which the Flax plant possesses of adapting itself to a wide range of climate is of great importance, as it enables mankind to cultivate such a valuable plant in so many countries, and under such diverse circumstances, which, were it not for this adaptability of the Flax plant, would be impossible.

THE SOILS ADAPTED FOR THE GROWTH OF FLAX, AND THE CONDITIONS FOR ITS SUCCESSFUL CULTIVATION.

As in the case of climate, so in that of soil, we find that the Flax plant is capable of growing under very diverse conditions; for we find it cultivated in soils partaking more or less of the sandy, argillaceous, calcareous, or peaty character according as sand, clay, lime, or vegetable matter—the four great constituents of soils in general—preponderate. And it appears that the success of the Flax crop does not so much depend on the particular kind of soil in which it is grown, as on the condition to which that soil has been brought, and the skill and attention bestowed on the culture and management of the crop. However, as in the case of other plants, there are certain soils which appear to be more especially adapted for the growth of this plant; and it is a point of some practical importance to know the description of soil best adapted for the Flax crop, where the agriculturist may have different kinds of soil at his disposal for its culture.

General experience seems to show that Flax succeeds best on a deep loamy soil, or one in which there is an intimate admixture of those four soil constituents just mentioned, in such proportion as to partake to some extent of the properties of each. Further, it should at the same time be neither too wet nor too dry, and of such an open and friable character as will readily permit the delicate fibrous roots of the Flax plant, which frequently grow to a length of two or three feet, to extend themselves freely in a vertical and lateral direction in search of food. For this reason, strong stiff clays should be avoided, as they do not permit this ready extension of the roots. On the other hand, very dry gravelly soils are found to be unsuitable for the growth of this crop. However, as a general rule, Flax may be grown on any soil of even moderate fertility; but of course it will grow in the greatest luxuriance, and yield the largest produce, where the land is most fertile and of that open and friable character which seems to be best adapted to its nature.

The conditions for its successful cultivation, are—that the soil be deeply tilled, well cleaned and drained, and be at the same time in good heart and tilth. The importance of each of those conditions, as regards the growth of Flax, is easily understood: thus, depth of tillage, whether effected by the plough or spade in preparing the soil for Flax, as for other crops, has the effect of increasing the feeding ground, as it were, from which the plant receives its earthy food, and places at its disposal a larger amount of those mineral substances which are indispensable to the growth of this as of other crops; and thus materially aids and favours the growth and development of the plant.

As to cleaning and freeing the soil as much as possible from weeds in the cultivation of Flax, its importance is obvious to any one who reflects, that where the same soil is producing two crops—the one yielding the agriculturist either money or meat, and the other neither, whilst at the same time it is consuming rapidly the available mineral food for the remunerative crop, and thus impoverishing his land—the sooner and more completely such crops are got rid of, the better.

This is more particularly the case in the growth of Flax, which, being in its cultivated condition of a delicate and slender habit, is ill fitted "to rough it,"—as it has been happily expressed—with the stouter and stronger indigenous weeds.

As to draining, the many beneficial effects produced in the soil by that process, consequent on the removal of excessive moisture, and the admission of air, which are so well known and seen in the growth of our other crops, are especially required by Flax; and it is idle to expect that it will grow with profit where there is an over-abundance of moisture in the soil. Therefore, one of the most important points to be attended to in the growth of this plant is, that the ground be thoroughly drained.

The last two conditions referred to are—that the soil should be in good heart and tilth, or, in other words, that it should contain the necessary substances, and that its particles should be in a highly comminuted state. As to the first, its importance is obvious, for from no other source than the soil can this, like our other crops, derive those earthy constituents which are necessary for their growth and development. As to the second, that the ground should be in good tilth, this condition, which practice has long shown to be of great importance in the growth of all our crops—has only been recently fully appreciated by the vegetable physiologist and chemist; as it has been shown that the mineral food of plants cannot be conveyed to their roots from a distance by water percolating through the soil, because the latter, having a great attraction for those substances, readily removes them from water holding such bodies in solution, and retains them firmly locked up, as it were, in some physical state of combination, and consequently the rootlets must receive the principal supplies of their earthy constituents from those portions of the soil in immediate contact with them; and from such the substances required become gradually dissolved, either by some solvent action of the roots, by the agency of carbonic

acid, or by other circumstances not clearly made out, whereby the roots can gradually imbibe their mineral food, when and in such quantities as they require. Hence we see the necessity of having the soil in good tilth; for the finer the state of division to which we reduce its particles, the greater will be the surface of soil we enable the delicate rootlets of plants to come in contact with; and by thus increasing the surface of absorption, we enable them to acquire more readily, and in greater proportion, their necessary mineral constituents. This comminution of the particles of the soil is of especial importance in the cultivation of Flax, which, being a rapid growing plant (the whole period of its growth occupying only from about fourteen to sixteen weeks), and its rootlets being of a fine fibrous character, it requires to be rapidly supplied with nutriment, which condition will be fulfilled by having the soil where it is grown in good heart and tilth, and of a sufficiently open and friable condition to allow the rootlets freely to extend themselves in search of food.

THE ROTATION IN THE CASE OF FLAX, AND THE PREPARATION OF THE SOIL FOR THAT CROP.

As to the crop which Flax should follow or precede in rotation, the peculiar characters of this plant enable it to occupy almost any place in the rotation which the nature of the soil, the climate, the market, or the circumstances of the grower, may render most advantageous: thus, it may follow or precede a grain or a green crop, a forage plant or a following; such positions it is found occupying in different countries where it is extensively and successfully cultivated.*

As a general rule, however, the best rotation on soils of average quality is after wheat or other grain crops, for the following reasons—that, after the reaping of those crops, the autumn affords an opportunity for having the land thoroughly cleaned and deeply ploughed, and for leaving it in such a state exposed to the air during the winter, that its decomposing and disintegrating action may produce a fine tilth. The stubble, too, of those crops acts beneficially in keeping the land open, and thus facilitating the action of frosts and rains in this disintegrat-

* The North-East Agricultural Association of Ireland, in their directions for the proper management of the Flax crop, recommend the following rotations:—

RICH SOILS.	AVERAGE SOILS.	POOR SOILS.
1. Grass.	1. Grass.	1. Grass.
2. Oats.	2. Oats.	2. Oats.
3. Flax.	3. Potatoes or turnips.	3. Potatoes.
4. Potatoes or turnips.	4. Wheat.	4. Flax (on half only).†
5. Wheat.	5. Flax (on half only).†	5. Hay.
6. Clover hay.	6. Clover hay.	
7. Pasture.		

† Omit Flax in next rotation on this half.

ing process, and thus materially aids in producing a fine condition of the surface soil, suitable to receive the seed in the following spring.

Mr. Wilson, in his valuable little work, "Our Farm Crops," observes, in speaking of the cultivation of Flax, "that if the land intended for that crop has been thoroughly tilled and cleaned in the autumn, and left with a good deep winter furrow, it will require but little preparation in the spring: at that period of the year," he says, "*it is always better to avoid using the plough, if possible*, because the finely weathered surface is by it turned in; and it is well nigh impossible by any mechanical treatment of the soil, to reduce a fresh furrow slice to the same tilth; while every time any implement or animal passes over the surface, it becomes compressed and consolidated, and in some soils and seasons materially injured."

Though what Mr. Wilson states as to the desirability of not using the plough in spring appears in theory to be correct, there is much diversity of opinion and practice on this point; for many recommend and adopt spring ploughing. If, however, it is thought desirable to plough in spring, it should not be deeper than about three or four inches, so as to preserve the winter surface for the growth of the plant, and it is always better that it should be performed some time before the sowing of the seed, which will allow the seeds of different weeds remaining in the ground to vegetate, and by so doing, many of them will be killed or removed in the subsequent harrowings of the soil to prepare it for receiving and covering in the seed, and thus avoid a good deal of trouble in the weeding of the crop afterwards.

As to the application of manure to the ground intended for Flax, its direct employment in this country is not generally practised, fearing lest the rankness of growth resulting from it would render the Flax more liable to lodgment, and consequent injury during summer rains; besides, it is thought that the ground is sufficiently enriched by the manure employed in the growing of the preceding crops. If, however, the land is considered too poor, it may receive a light application of any of our ordinary manures, or artificial Flax composts, which may be applied before the last harrowing of the ground to prepare it for the seed.

I shall defer all further details as to the preparation of the ground, the sowing of the seed, and the subsequent treatment of the crop, till the latter part of this paper, in which, under the Directions for the Proper Management of the Flax Crop, these and other practical matters connected with the culture of Flax, will be fully treated.

CHEMISTRY OF THE FLAX PLANT.

I shall now offer a few remarks on the chemistry of the Flax plant, which will enable us to judge whether one of the great arguments against the extension of the growth of Flax, viz., that it is a very exhausting crop, is a fair one. Flax, like other plants, consists of two parts, viz., the organic and inorganic—the combustible and incombustible, or mineral portion. The former, which constitutes the chief part of the plant, con-

sists, as is well known, of four simple bodies, viz., carbon, hydrogen, oxygen, and nitrogen, the first three or all of which, grouping themselves together in certain proportions, form the cellulose of which the fibre consists, the oil, and other organic substances produced during the growth of this plant. The latter,—the inorganic or mineral part, which constitutes the ash that is left when the plant is burnt,—consists of some nine or ten different substances, and amounts to from three to four and a half per cent. of the seed, and about five per cent. of the straw of the Flax plant; and though the quantities of each of those mineral matters are small when compared with the organic part, still they are all indispensably necessary to the growth of this, as of our other crops.

In the nutrition and growth of Flax, as of other plants, the organic elements—the carbon, hydrogen, oxygen, and nitrogen—are supplied directly or indirectly, under different compound forms, from the atmosphere, in unlimited quantities. The inorganic or mineral substances, however, not occurring in the air, can be only derived from the soil. Now, though all of those nine or ten mineral substances are equally important as regards the growing plant, they are not practically of equal value to the agriculturist, for this reason, that some of them occur in almost inexhaustible quantities in most soils, and therefore require little or no attention on his part, whereas others, occurring more sparingly in soils, may be either originally deficient, or by the continued growing of different crops which remove more or less of them be soon reduced to such a small proportion, that the soil cannot yield the necessary quantity, and consequently different crops (especially those that require a good supply of the deficient substances) cannot be grown, at least with any profit, on such impoverished or exhausted soils. Therefore, it is those sparingly distributed mineral matters that require the especial attention of the agriculturist. Now, general experience seems to show that the two most important of the mineral constituents of plants, as regards the agriculturist, are—*phosphoric acid and potash;* not only because they are generally sparingly distributed in the soil (at least, in an available condition), but likewise as being the most costly to purchase of the mineral constituents of our manures.

All our agricultural crops are more or less exhaustive; that is, they all remove from the soil those mineral substances required by plants. But some of them, requiring a larger amount of those sparingly diffused substances (particularly the two bodies just referred to), may, in one sense, be considered more exhaustive than others for the generality of soils.

We shall now consider what are the total quantities of mineral matter, of phosphoric acid, and of potash, which from the results of chemical analysis have been estimated to be removed from the soil by average crops of some of our most important plants, including Flax; those quantities are shown in the following Table:—

Total Quantities of Mineral Matter, of Phosphoric Acid, and of Potash, removed from a Statute Acre by an Average Crop of the following Plants:—

		Entire Mineral Matter.		Phosphoric Acid.		Potash.	
			Total Quantity.		Total Quantity.		Total Quantity.
Wheat, .	in the Grain, . .	25 lbs.	bs.	11·47 lbs.	19 65 lbs.	7·49 lbs	25·70 lbs.
	" Straw, . .	153 "		8·15 "		18·21 "	
Oats, . .	" Grain, . .	58 "	228 "	10·55 "	14·90 "	9·72 "	42·26 "
	" Straw, . .	170 "		4·35 "		32·54 "	
Barley, .	" Grain, . .	49 "	208 "	17·25 "	22·43 "	9·68 "	38·93 "
	" Straw, . .	159 "		5·18 "		29·25 "	
Beans, . .	" Grain, . .	63 "	231 "	23·67 "	35·83 "	22·63 "	111·80 "
	" Straw, . .	168 "		12·16 "		89·17 "	
Peas, . .	" Grain, . .	96 "	432 "	32·18 "	48·41 "	35·85 "	51·74 "
	" Straw, . .	336 "		16·23 "		15·89 "	
Potatoes, .	" Tubers, . .	400 "	580 "	50·28 "	63·99 "	223·00 "	273·43 "
	" Tops, . . .	180 "		13·71 "		50·43 "	
Turnips, .	" Bulbs, . .	340 "	640 "	33·11 "	60 99 "	125·73 "	201·68 "
	" Tops, . . .	300 "		27·87 "		75·95 "	
Beet, . .	" Bulbs, . .	483 "	1539 "	19·80 "	78·00 "	149·70 "	385·50 "
	" Tops, . . .	1056 "		58·20 "		235·80 "	
Flax, . .	" Bolls, . . .	48 "	272 "	18·00 "	33·50 "	11·00 "	25·00 "
	" Straw, . .	224 "		15·50 "		14·00 "	

The above quantities in the case of all the crops, with the exception of Flax, are from the results of analyses by different chemists, given in Morton's "Cyclopedia of Agriculture," where the quantities taken as average crops are estimated at the following amounts:—

Wheat, ...	Grain, . .	25 Bushels, at 60 lbs. each.
	Straw, . .	at twice the weight of the Grain.
Oats, ...	Grain, . .	50 Bushels, at 40 lbs. each.
	Straw, . .	at two-thirds more than the Grain.
Barley, ...	Grain, . .	40 Bushels, at 52 lbs. each.
	Straw, . .	at one-fourth more than the Grain.
Beans, ...	Grain, . .	25 Bushels, at 63 lbs. each.
	Straw, . .	at 2800 lbs.
Peas, ...	Grain, . .	50 Bushels, at 64 lbs. each.
	Straw, . .	at 5600 lbs.
Potatoes, . . .	Tubers, . .	at 8 Tons.
	Tops, . .	at $4\frac{1}{2}$ "
Turnips, ...	Bulbs, . .	at 20 "
	Tops, . .	at 6 "
Beet, ...	Bulbs, . .	at 30 "
	Tops, . .	at 5 "

The quantities in the case of Flax are from the results of Dr. Hodges, who estimates two tons of straw, and sixty bushels of bolls, dried, and weighing 960 lbs., as an average crop of Flax.

From the above Table it would appear, taking one thing with another, that there is no great difference between the exhaustive power of Flax and our ordinary cereals—that in some respects it is less so than beans or peas; but that it is far less exhaustive than either potatoes, turnips, or beet, whether we consider the total quantity of mineral

matter, the phosphoric acid, or the potash removed from the soil; so that we cannot regard Flax as a particularly exhausting crop, as is generally done.

But here we view it under the most unfavourable aspect; for it rarely happens that the whole of the crop is sold off the farm, but the seeds, or a portion of them, are used for feeding purposes, and the straw is very commonly steeped there, and it is only the Flax fibre that is disposed of.

If, however, the water which is used in steeping the Flax was employed for irrigation, and the expressed seeds or linseed cake, for feeding the cattle on the farm, we would return to the soil almost all the mineral matters taken up by the plant; for the Flax fibre and oil—the two most important products of this plant—retain, after proper preparation, but a very small proportion of mineral matters—those of the straw remaining to a great extent in the water used for steeping, and those of the seed in the expressed cake.

These statements are borne out by the analyses of Sir Robert Kane, the late Professor Johnston, Messrs. Way and Ogston, Dr. Hodges, and other chemists, who have investigated this subject, and have all maintained the non-exhausting characters of Flax if properly cultivated.

From the elaborate and important investigations of Messrs. Way and Ogston on the mineral constituents of plants, these gentlemen have been led to conclude that an average crop of Flax contains a larger amount of mineral matter than an average crop of any of our cereals produced from the same extent of ground; but that only a small portion of that matter belongs to the fibre, the part of the plant which is permanently removed from the soil, and that this consists almost entirely of comparatively valueless substances. The really valuable soil constituents, they find, are contained chiefly in the leaves, which in a great part drop off on the field, in the seed and seed vessels (which should be returned to the soil in the form of manure); and, lastly, in the organs of the stalks, irrespective of the fibre. They have further ascertained, that about four-fifths of the soil constituents contained in the stalk, and those the most valuable (phosphoric acid, potash, &c.), are extracted by the water during the operation of steeping; and that nearly three-fourths of the remaining portion are again separated with the woody parts by the scutching, &c., leaving only a minute quantity (comparatively speaking) of mineral matter in the fibre.

Consequently, the results of those gentlemen confirm, in a most satisfactory manner, the statements of other chemists as to the Flax plant, the cultivation of which by no means produces a necessary exhaustion of the soil, which almost ceases when the refuse matters obtained in the separation of the fibre, especially the water used in steeping the Flax, are returned to the soil.

From Dr. Hodges' experiments, he calculates, that if the fibre were only sold off the farm, a crop of two tons of straw per acre would remove only about five pounds of mineral matter—a quantity too small to exercise any appreciable injurious effect on the fertility of the soil.

Flax, therefore, instead of being (as is very unjustly regarded) one of the most exhaustive crops, would, if so cultivated, be one of the least in this respect that we could possibly grow. Nay, more, it would certainly have the effect of increasing the fertility of the soil; because the tillage and the workings of the ground—which are so necessary for the successful cultivation of Flax—must tend greatly to improve the physical and chemical condition of the soil, rendering it far more suitable for the growth of other crops.

In proof of this, I may remark, that the Flemish agriculturists, who may be justly considered as the most successful Flax growers in Europe, and best agriculturists generally, regard Flax, not as a crop that exhausts, but as one that improves the condition and fertility of the soil.

But, supposing that no part of the plant is returned to the soil, all being sold off the farm, and even granting that this crop removes a larger amount of those sparingly-diffused mineral substances (which we have shown is not the case), still, the Flax plant being such a rapid grower, and consequently occupying the ground for so short a period, and yielding when properly cared a greater money return than any of our other crops, its cultivation would be highly profitable, and leave the grower after purchasing, if he could not produce, the manure necessary to maintain the fertility of his ground, a larger profit, generally speaking, than he could possibly obtain by the exclusive culture of the less remunerative cereal and green crops.

THE PRACTICABILITY AND ADVANTAGES OF EXTENDING THE GROWTH OF FLAX IN IRELAND.

So much has been said and written of late on the practicability and advantages of extending the cultivation of flax in this country, that it is scarcely necessary for me, in a Paper like this, to dwell on that part of the subject, or to urge the desirability of those who have influence and wish for their country's prosperity uniting their efforts in furtherance of this national object, which promises, if carried out properly, to improve the condition of all classes throughout Ireland, and will, it is hoped, by giving increased employment, stem to some extent the great current of emigration taking place from our shores.

I may, however, observe, that the practicability of growing Flax in other parts of Ireland besides the North may be inferred from what I have already stated, as to the great power the Flax plant possesses of adapting itself to such a wide range of soil and climate; furthermore, practical experience has shown that Flax may be successfully grown in almost every part of Ireland. And the desirableness of extending its cultivation may be inferred from seeing the very prosperous condition of those parts of this country where Flax is extensively grown, as in the province of Ulster; which, were it not for the cultivation of the Flax plant, and the manufacture of linen from its fibre, would now be some of the most impoverished and backward parts of this country. And so fully alive are the people of the North of Ireland to the growing importance

of this branch of agricultural and commercial industry, that they have greatly extended the cultivation of this plant; whilst in other districts of Ireland their example has been recently followed to some extent; so that there was a greater amount of Flax produced last year in Ireland than was ever previously grown in this country, and greatly in excess over the former year; thus, the number of English acres under Flax in 1862 was 150,070 acres; and in 1863, 214,099 acres—being an increase of 64,029 acres, or considerably more than one-third greater than in the preceding year; and the Flax crop on the whole appears to have been in every way most profitable; and in many instances large sums were realized by different individuals from the sale of their Flax crop; and though there was a much larger supply, the price of Flax still kept up, from the great demand for that substance.

In the present year, the amount of Flax sown throughout Ireland, as far as can be learned, greatly exceeded that sown last year;* and the prospects of the crop appear to be very good.

Again, there is no reason why other parts of Ireland should not as well as the North participate in the advantages derivable from the growth of Flax; for it is generally believed that the soil and climate of many other districts are far more favourable to the growth of this crop than the colder and more mountainous districts of the North; and there are many instances of Flax being grown in the South, and in other parts of this country, with the greatest success and profit to the grower.

ADVANTAGES OF THE FLAX CROP.

Amongst the advantages of the Flax crop may be mentioned the following:—

First,—It is not so liable to be injured by wet seasons as our cereals and other crops. This is shown by the experience of the last few years, which have, as is well known, been very injurious to our grain crops, but have not affected (at least to the same extent) that of Flax.

Second,—Its growth is very rapid, so that it occupies the ground a short time, comparatively speaking, and thus enables us to grow a greater number of crops on the same soil.

Third,—It is far more profitable, when properly attended to, than any of our other crops. It is difficult, however, to state what is the average yield and profit on an acre of Flax, as they vary so much according to a great variety of circumstances.

Fourth,—Its culture supplies not merely a source of agricultural, but of industrial employment; in this respect it is more beneficial than any of our grain or other crops occupying the same extent of ground, in addition to its being more valuable.

---

* From the recent returns of the Registrar-General for the present year, published September, 1864, we learn that the acreage amount of Flax sown this year exceeds that of last year by 87,761 acres.

Fifth,—It may at all times be included in the ordinary rotation of crops without fear of exhausting the soil, if we do not grow it too frequently on the same ground, or take care to return to the soil, either in the Flax water and linseed cake (the latter having served first as food for the cattle on the farm), or in some other manure, the mineral substances removed by the crop. If Flax be cultivated with these precautions, the fertility of the ground will remain unimpaired for any number of years.

That these and many other advantages derivable from the growth of Flax are now so generally admitted, and that its more extended cultivation in Ireland is considered both practical and tending to improve the condition of this country, is evidenced by the active measures which are now taking place throughout Ireland to carry out this important object. Thus, we hear of meetings being held of the different agricultural societies, and of the chief persons of various towns and districts, to encourage the extension of the growth of Flax in this country. Nay, more, companies have been formed in different places, and other active steps taken to give immediate effect to the advancement of this great national object,* which, if attained, there can be no doubt would materially improve the agricultural, social, and commercial condition of Ireland.

DIRECTIONS FOR THE PROPER MANAGEMENT OF THE FLAX CROP.†

THE SEED, AND THE SOWING OF IT.

IT is a matter of much importance to the grower of Flax to select proper seed, as a good deal of the success or otherwise of the crop will depend on the kind which is sown. Foreign seed is universally preferred; and for the generality of soils that obtained from Russia, and known under the name of Riga seed, is the best, although Dutch seed in many districts has been used for a series of years with perfect success, especially in the case of heavy damp soils, and is said to yield a Flax of finer fibre, though not so large a crop as that grown from Riga seed. If neither can be procured, home-grown seed may be used, it being preferable to American, which from its producing plants having a tendency to branch, instead of growing with single erect stems, causes much of the fibre to be lost in the scutching. In purchasing seed, that

---

* In furtherance of that important object, since this Paper was read, the Government have granted a sum of £2000, which has been placed at the disposal of a joint committee of the Royal Dublin Society and of the Royal Agricultural Society, for the encouragement and promotion of Flax culture in this country.

† Though the Directions here given for the proper management of the Flax crop were not read before the meeting of the Royal Dublin Society, it was thought that this paper, when published, would be rendered much more practically useful by having them added to it.

which is shining, plump, heavy, and feels slippery to the hand, should be selected, as indicating that such seed is fresh, a circumstance of much importance, as seed beyond a year old should not be sown. In all cases, however, it will be safest to buy the seed from the most respectable establishments, even though by so doing the cost of the seed may be somewhat greater.

Before sowing, the seed should be sifted, to separate from it the seeds of all weeds it may contain, which will save a great deal of trouble in the weeding of the crop afterwards. This may be effected by using wire sieves having twelve bars to the inch, which, being constructed for this purpose, can easily be procured.

As to the proportion of seed that ought to be sown, it may be stated at from two to three bushels to the statute acre; the former quantity for poor, and the latter for rich soils; about $2\frac{1}{2}$ bushels, or 126 lbs. of clean seed being taken as a fair average quantity.

It should, however, be remembered that it is always better to sow rather too thick than too thin, when the principal object in growing Flax is the fibre; for, when thickly sown, the stems grow tall and straight, and but slightly branched at the top, producing a fibre far superior in length and fineness to that of Flax grown thin, which on the other hand is much branched, and produces a good deal of seed, but the fibre of which is coarse, and of very inferior quality.

The ground having been well pulverized and cleaned by previous ploughing and harrowing, a light roller should be passed over it, to give an even surface, and produce a certain amount of consolidation; after which a short toothed or seed harrow follows; and if the ground has not been laid down in ridges, it should be marked off in divisions of from eight to ten feet in width, for the better distribution of seed at the time of sowing. On the ground so prepared, the seed is sown broad cast, by hand or machine, in the proportion stated; and after the sowing of the seed, which should be done by a very skilful person, it is covered by passing a seed harrow once up and down the divisions, and once across or anglewise, which has the effect of distributing the seed more evenly, and avoids the small drills made by the teeth of the harrow. This being done, a light roller should be passed over the ground, unless it is so wet as to adhere to it in clods, when of course that operation should be dispensed with, being then far more injurious than beneficial. In the sowing of Flax it ought also to be borne in mind that the seed should be covered only by about one inch of earth, which is the proper depth at which it ought to be placed in the ground.

As to the time of sowing, the end of March or the beginning of April is the period that is generally recommended, and it is of great importance that it should be done in dry weather. But the time of sowing will to some extent be influenced by the special object in view in the cultivation of Flax: thus, when it is grown for fibre alone, or for the fibre and seed together, it is better to sow somewhat earlier than when the production of seed is the principal object; for, when sown late, the crop grows so quickly during the early summer months, that

the vegetative processes are too rapid to give sufficient time for the consolidation of the tissues, which is necessary for the production of good fibre, and which the slower vegetation of the spring months generally secures where the sowing has been performed early; consequently, for fibre purposes, about the last week in March, if the season is mild and favourable, is the best time; when both fibre and seed are required, the sowing may be a week or two later; and when the production of seed is the principal object, it may be delayed till about the end of April.

THE WEEDING OF THE CROP.

If proper care has been bestowed on the cleaning of the seed and the ground, but few weeds will make their appearance; these, however, must be removed by careful hand-weeding. This is best effected when the Flax has attained a height of about three or four inches; but should be done before it exceeds six inches; for, if left longer, the Flax will be injured during the weeding. This process is generally performed by young persons, or females, who with coarse cloths round their knees, or having them well padded, weed in a kneeling posture, and creep along the ground on all fours. By this method the young Flax plants are less injured than by walking over the ground, especially if the weeders have shoes furnished with nails. For this operation a dry, windy day is most favourable; and the weeders should always work facing the wind, so that it may assist in raising the Flax plants which have been bent down in that direction during the weeding process. When the Flax, however, has been sown in ridges (as is sometimes done, especially where the ground is wet, or not properly drained), the weeders should work sideways from the pathways or furrows between the ridges, so as to injure the Flax as little as possible.

THE PROGRESS OF THE FLAX CROP, AND THE PROPER TIME FOR PULLING IT.

The plant having attained a height usually of about two feet (though sometimes growing much higher), flowers towards the latter end of June, or early in July, when its delicate blue blossoms present a very beautiful appearance. After the flowers fall off, the seed capsules or bolls begin to form, and acquire their full size about the middle or latter end of July. When fully formed, they are nearly globular, with the top surfaces slightly drawn up to a point; and on opening them are found to have usually ten cellular divisions, each containing a single seed, appearing at first as a colourless integument, enclosing a mucilaginous liquid, which soon assumes a more solid consistence, changing to a pale green, and afterwards, as the seed ripens, passing into a brown colour. As the plant becomes more matured, the stalks near the ground lose their green appearance, and assume a yellow tint, becoming at the same time considerably harder, from the contraction of the vessels through which the sap was conveyed; and this alteration will proceed gradually up the stem until it reaches the seed capsules, indicating the

passage of the sap into those organs for the maturing of the seed; and soon after this, the plant, having completed the term of its existence, sheds its seed, and dies.

As to the proper time for pulling the plant, this depends on the principal object we have in view in cultivating Flax. Thus, if it be for the purpose of producing seed for either sowing or for the production of oil, the plant must remain until its seeds are ripe, which will be denoted by the hardened condition of the seed capsules, and the brown appearance of the seed, together with the yellow colour of the stems, and the falling off of the leaves. But if (as is generally the case, at least in this country) the object is the fibre, we must not allow the plant to be fully matured; for, if so, the fibre will be coarse, and of inferior quality. If, on the other hand, we pull it too early, although the fibre is fine, the great waste which is produced in the scutching and hackling renders it unprofitable. It is, therefore, a point of much practical importance to know the proper time at which Flax should be pulled.

General experience has shown that where Flax of good quality, but not of extreme fineness, is required, the best time for pulling is when the seeds begin to change from a green to a pale brown colour, and when about two-thirds of the stalk from the ground have become yellow. When, however, Flax of the very finest fibre is required, as in the manufacture of certain cambrics and muslins, it should be pulled before this, and is sometimes removed from the ground so early as when the Flax begins to flower. But the former practice is generally far the most profitable; for the higher price brought by the finer Flax does not compensate for the greater yield of fibre in the more matured plant, and for the seed, which may be very profitably used for feeding purposes, for the extraction of its oil, or even occasionally for sowing.

The Flax, as is well known, is pulled by simply catching it in small handfuls below the seed vessels, and laying each handful on the ground one across the other diagonally, taking care that the root ends of each bundle should be even like a brush, which will increase the value of the Flax to the spinner, and consequently to the grower, who will be fully repaid by the higher price received for any additional care and trouble bestowed in making up and placing the handfuls properly. After the pulling of the Flax, much diversity of practice exists as to its subsequent treatment previous to the steeping process, which, without going into some minor points of difference, may be divisible into the three following courses—viz., 1st. The Flax may be immediately freed from its seed capsules or bolls by rippling, and then steeped at once; 2ndly. It may be made into stooks or bundles of a peculiar construction, in which state it is suffered to dry gradually, and when this has been effected, the seed is removed by beating or rippling it, and the straw is shortly afterwards steeped; or, 3rdly. It may be dried, as before, and being stacked or otherwise stored up (the seed having been removed previous to the storing or subsequently, when convenient), the Flax straw is steeped the following summer. The first course, however, being the one which is generally practised (at least in this country),

and is that which is most recommended to be adopted here, it will be well to describe it a little more in detail.

THE RIPPLING OF THE FLAX.

The Flax, having been pulled in the manner stated, is at once freed from its seed capsules; this, adopting the first course, is very easily effected by drawing it in small handfuls through a sort of comb termed a ripple, which is a simple instrument, consisting of a row of iron teeth* screwed into a block of wood. This, taken to the field where the Flax is being pulled, is fastened to the centre of a plank about nine feet long, supported on two stools. At the opposite ends of this the ripplers may either stand or sit astride, being at such a distance from the comb as to allow of their striking it properly and alternately.

The handfuls of Flax being placed diagonally across each other (as already stated, in the pulling), and bound up in bundles or sheaves, these are laid down at the right hand of the rippler, and untied, when he, taking up a handful and grasping it firmly with the one hand about six inches from the roots, and with the other having spread it out at the top so as to present a broad fan-like surface to the ripple, draws it quickly through the comb, and thus detaches the bolls. There is, however, some care and dexterity required in this process, so as not to injure the fibre, and the proper manner of performing it is best learned from those already acquainted with it. After the Flax is thus deprived of its bolls, the rippler lays it down on his left-hand side, placing one handful across the other, after which it is tied up into sheaves, and removed. The object of thus crossing the handfuls after rippling in tying up the sheaves is, that they may easily be separated from each other after the process of steeping, and spread out evenly in the subsequent grassing of the Flax. As to the bolls, they should be carefully collected by placing a winnowing sheet or cloth on the ground under the ripple to receive them as they fall off, the seed they contain being, as is well known, very valuable as a food for cattle, as well as for the manufacture of oil.

If the weather be dry, the bolls should be suffered to remain in the field, spread out on the winnowing cloths or other contrivance for drying, turning them from time to time to assist their drying; they may then be passed through a coarse riddle, and afterwards through fanners, to separate straws and leaves. If, on the other hand, the weather be moist, the bolls must be dried within doors, by being spread on the floor of a barn or loft where they can be exposed to a current of air, and turned twice a day.

---

* The teeth of the ripple should be made of rod iron, half inch square, placed in the block so as to be three-sixteenths of an inch apart at the bottom and half an inch at the top, the angles of the iron being turned so as to be opposite the ripplers. These teeth should begin to taper to a point three inches from the top, and be about eighteen inches in length, which will give sufficient spring, and save much breaking of the Flax during the rippling process. Such an instrument can be readily made by any handy blacksmith.

When they are nearly dry, they are removed to a corn kiln, where they are exposed to a temperature not exceeding a summer heat, being carefully turned as long as moisture remains. By this plan of slow drying, the seed absorbs all the juices which remain in the husk, and becomes quite ripe. If, on the other hand, it is at once taken from the field, and dried hurriedly on the kiln, the juices will be destroyed, and in the shrivelled and dried-up seed but little nutritious matter will remain.

The bolls being thus dried and cleaned, either within or without doors as the case may be, the seed may be threshed out, when the plumpest and heaviest portion should be reserved for crushing, or even sowing, and the lighter seed and chaff may be very profitably employed as a food for cattle.

Adopting this treatment of Flax, it ought not, if possible, to be allowed to remain on the field the second day, but should as soon as it is pulled be rippled, and then immediately put to steep, in order to prevent its hardening, which would retard the various fermentative changes which take place during the steeping of the Flax.

THE STRUCTURE OF THE STEM OF THE FLAX PLANT, AND DIFFERENT MODES OF TREATING THAT PORTION OF THE PLANT TO EFFECT THE SUBSEQUENT SEPARATION OF ITS FIBRE.

The ultimate object of the steeping, and of other processes to which the stem of the Flax plant is afterwards submitted, being, as is well known, the separation of the fibre, it will be well to consider its structure, in order to understand more clearly how the different processes adopted may aid more or less in effecting that object. If a portion of the stem of this plant be broken across, and then carefully examined, it will be found to consist chiefly of three distinct parts—viz., the centre hard cellular tissue, having all the appearance of wood, and usually called the shove, or boon; a tubular sheath, placed around this, composed of bundles of long and tough fibres, cohering to each other firmly; and exterior to this, a thin and delicate skin or bark,— the whole, but especially the fibres, being as it were cemented together by a nitrogenous compound. This substance it is necessary to separate, in order to detach the fibre, and obtain it in a state fit for manufacturing purposes; but so intimate is the nature of its union with the fibre, that mechanical means alone are quite insufficient for its complete separation. Various methods have been proposed and adopted, which effect more or less completely the removal of this cementing substance; these may be divided into two classes—viz., those which accomplish its removal by directly dissolving it, and those which produce the same effect by its gradual decomposition.

Amongst the first are the various alkaline and acid chemical solvents, as well as steam and water at a high temperature; these, especially the latter, though they promised to be very advantageous, have not in practice realized the expectations entertained regarding them, and have consequently been almost entirely discarded. As to the second class, wherein

the cementing material is removed by effecting its gradual decomposition, this object is carried out differently in different countries;—thus in some parts of America it is effected by leaving the Flax spread out on the grass to the action of the atmosphere for several weeks, whereby the cementing substance is gradually decomposed, so that the fibre can then be separated by the different mechanical processes through which it afterwards passes. This, however, is a very tedious process, and one attended with many disadvantages. The same end is more quickly and much better attained by steeping the Flax in water, which is the process adopted in most countries. This is carried out by either placing the Flax in very slow running streams or rivers, as in Belgium and some other parts of the Continent, or by putting it in pools specially constructed for that purpose, as with us,* and also adopted in many other countries. We shall therefore confine our remarks on steeping to the latter method of conducting it.

THE STEEPING PROCESS.

This operation requires much care and attention, as the value of the fibre and the profit it yields depend more, perhaps, on the manner in which it is performed than on any other operation of the Flax grower; consequently, it will be well to consider it somewhat in detail.

First, then, as to the pond or pool in which the steeping is conducted.—This should be made, if possible, some time before it is required, and in choosing a site for its construction particular attention should be paid as to the supply of water suitable for the process. It is desirable also that the situation should be warm and well sheltered, though not too much shaded by trees or otherwise. If these two circumstances as to water and situation are favourable, others are comparatively of minor importance.

The kind of water which is best adapted for the steeping of Flax is river water, especially that which has flowed for some distance exposed to the action of the air, by which more or less of its earthy salts are separated, rendering it softer, and more suitable for this purpose. Water which has flowed over peat, or through peaty soils, is generally found to answer very well. But, on the other hand, waters which contain a large proportion of carbonate of lime, and other earthy salts (as is generally the case with spring waters), giving to them more or less of the well-known character of *hardness*, are unsuited for the steeping of Flax; and waters which have anything of a ferruginous character from the presence of salts of iron should be especially avoided, as they are quite unfit for that purpose. As to the pool itself, the best size to construct it is from twelve to eighteen feet broad, by from three and a half to four feet deep, the length being in proportion to the quantity of Flax to be steeped; but

* A clause in the Fishery Laws of this country prohibits the steeping of Flax in rivers or streams, on account of its rendering the water poisonous to fish, and great numbers having been before that prohibition destroyed during the steeping season.

with the breadth and depth given, a pool of about thirty feet in length ought to be sufficient to steep the Flax of one acre. The kind of soil which forms the bottom of the steep pool is thought to influence to some extent the colour of the fibre, a clay bottom being said to give a yellowish-white tinge, an alluvial soil, a bluish shade, whilst a peaty one produces frequently a very pure white. It is advisable that a small drain, six or eight inches deeper than the bottom of the pool, should be cut at a distance of a few feet from it on every side, for the purpose of either preventing any water passing from the surrounding soil into the pool which might injure the Flax ; or, on the other hand, to prevent the water from the pool passing into the surrounding soil.

If the ground be of a very porous character, it may be necessary likewise, in making the steep pool, to guard more effectually against the escape of water from the pool itself; this will be best effected by cutting a deep and narrow trench parallel to the sides of the pool, at a distance of about three or four feet from its sides, and then filling it with clay, which should be rammed hard, so as to render it as impervious to water as possible.

If river water cannot be obtained or made available for the filling of the pool, and recourse is obliged to be had to spring water, it should be put in the pool some five or six weeks before the steeping of the Flax, in order that the exposure to the air, by the separation it effects of more or less of its calcareous salts, may render it as soft as possible.

It will be sufficient, however, in the case of river water, to place it in the pool a day or so previous to the steeping of the Flax.

The water being in a fit state, the Flax is put into the pool in regular rows, the sheaves or bundles resting on their butt ends, and standing nearly upright, so that when the pool is filled it presents the appearance of a dense crop, with the summit of the stems just appearing at the surface of the water; or, as is frequently adopted, the bundles are laid on the flat in regular rows, the ties of each succeeding row resting on the roots of that immediately below it.

The Flax is then covered with either sods of grass, the green side resting on the Flax, with wheaten straw kept down with stones, or with logs of wood ; the object being to keep the Flax completely under water, yet at the same time not resting on the bottom of the pool.

Where the water is at once suitable for steeping, as where there is a reservoir or pond at command, many adopt the practice of packing the Flax in the pool and covering it over in the way described first, and then letting in the water, which has this advantage, that the Flax can be better and more evenly packed than where the pool is full of water at the time of putting in the Flax.

After the Flax has been in the water a few days it swells, and becomes lighter, by the gases evolved during its fermentation, and additional weight must be placed over it to keep it under the water, which should be afterwards removed as the fermentation lessens and the Flax again becomes denser. Sometimes, too, it may be advisable to let in or

draw off some of the water, to keep the Flax always, during its steeping, about two inches below the surface of the water, and not let it either be exposed to the air or be sunk too deep in the pool or resting on its bottom.

As to the time required to steep the Flax properly, this will depend on the temperature and state of the weather, the kind of water, the description of Flax, and many other circumstances; but as a general rule it will be sufficiently steeped after from eight to fourteen days, the process being more quickly effected in warm than in cold weather.

It is, however, of great importance that every Flax grower should know when the Flax has been sufficiently steeped, as its quality is much deteriorated by being left either too short or too long a time in steeping; and when it has arrived at a certain stage of the process, a few hours more or less materially affect the quality of the fibre, and consequently the profits of the Flax grower.

About the seventh day the Flax should be examined, the usual test being to take a few stalks of average thickness, and, breaking their shove or woody centre in two places, about six or eight inches apart, in the middle of the stalk, catch the broken shove with the fingers, and see if it can be easily pulled out (drawing it downwards) without breaking or tearing the fibre, and without any of it adhering to the shove. If this is found to be the case, the Flax has been sufficiently steeped, and should be removed from the pool without further loss of time; but if not so, of course the steeping must be continued. After the fermentation has subsided, this trial should be made about every six hours, as the changes which take place then are sometimes very rapid; and if the Flax be allowed to remain longer in steeping than is necessary, the fibre becomes weak and cottony; if, on the other hand, it is removed too soon, or before the test just mentioned indicates that it is advisable to do so, much of the fibre is broken off during the scutching, and its quality in general is coarse and dry.

When the test shows that it has been steeped enough, it should be very carefully removed from the pool; for in no state does the flax suffer greater injury from careless handling than immediately after steeping: consequently it should never be roughly lifted out of the pool with forks or grapes, but should be handed out carefully by men standing in the pool to others on the banks, the business of the latter being to place the bundles on their root ends close together, or on their sides, on a slope, where they are left to drain for from twelve to twenty-four hours before spreading; but the heaps should not be too large, lest the Flax might be injured by heating in that very damp condition.

As to the water itself which has been employed in the steeping, it should (where it is possible) be used for manurial purposes, as it contains a considerable amount of the most valuable mineral constituents of plants, and is found to constitute an excellent liquid application, especially for meadows.

THE SPREADING OF THE FLAX AFTER STEEPING.

The Flax, having been sufficiently drained, is removed to where it can be spread out, exposed to the air and light, the object being to cleanse and improve the colour of the Flax, as well as to dry it. For this purpose a clean, short, and thick piece of pasture ground should be selected; and, having mowed down or removed any weeds that may rise above the surface of the sward, lay the Flax evenly on the grass, spreading it out thin and very equally, which will be easily effected if the directions given under the head of rippling have been attended to; for the handfuls will then readily come asunder without being entangled. While on the grass, some recommend that it should be turned two or three times (which is done with a long wooden pole), with a view to prevent more completely its being of different shades of colour, from unequal exposure to the light and air, which is frequently the case from inattention to this circumstance. If it is to be turned, and should there be a prospect of rain, that ought to be done before it comes on, that the Flax may by the rain be beaten down, and made to lie close upon the grass, thus preventing its being blown about and disordered.

THE LIFTING AND DRYING OF THE FLAX BEFORE STACKING.

When the Flax has lain on the grass about six or eight days, if the weather be showery, or ten or twelve if it be dry, it ought to be ready in lifting. A good test of its being sufficiently thus exposed, or as it is termed "grassed," is to rub a few of the stalks from top to bottom, and if the wood or shove breaks easily and separates from the fibre, leaving it sound, the Flax has lain long enough on the grass; this is also indicated when a large proportion of the stalks or stems are observed to form a sort of bow and string, caused by the fibre contracting and separating from the central woody portion. But the most certain and most satisfactory test is to try how a small portion of the Flax behaves when submitted to the hand break or to the Flax mill.

In lifting the Flax, care should be taken to keep the lengths straight and the ends even, as otherwise much loss will occur in the subsequent breaking and scutching. Let it then be set up to dry for a few hours, and afterwards be neatly tied up in small sheaves or bundles; and if it is not to be soon scutched, it should be stacked, or packed under cover; but in either case it ought to be put up loosely, that the air may get through it, and that there should be no danger of its heating. If it is stacked out of doors, the stacks should be built on stones, brambles, or, better still, on pillars, in order to keep them dry at the bottom, and allow a free circulation of air about them; and, finally, they should be very carefully thatched, to prevent the Flax being injured by wet. In this way the Flax will not only keep for years, but it is thought that the quality of the fibre is improved by keeping at least up to the third or fourth year after steeping. Flax, however, is sometimes dried by artificial heat, which is effected by placing it on kilns; this practice is very generally and properly condemned, as being highly pernicious to the fibre, im-

pairing its quality, and consequently reducing its money value; and if the Flax has been properly steeped and *grassed*, no such drying is at all necessary, but to make it ready for breaking and scutching, simple exposure to the sun is all that is necessary.

BREAKING AND SCUTCHING.

The Flax is now ready to undergo the final operations of *breaking* and *scutching*, which have for their object the separation of the woody portion or shove from the fibre, so as to render it fit for the market. These may be done by the use of different very simple implements or contrivances worked by the hand, which are too well known to need description, or by machinery; and the preference given to the use of one or other depends on the circumstances of the Flax grower. It is by manual labour that the greater part of the Flax grown in Russia, Holland, and Belgium is dressed; and even in this country a good deal of Flax is so prepared for the market, though by far the greater portion is dressed by machinery; and it is generally admitted that less injury is done to the fibre by hand breaking and scutching than where mills worked by steam, water, or horse power are employed for those purposes. Manual labour, however, has this great drawback, that it occupies much more time than machinery, and consequently the latter is becoming more and more generally employed; and improved and powerful breaking and scutching mills have been recently erected in various parts of the country, which, though still susceptible of further improvement, effect a great saving of time and labour in preparing the Flax for the market. But the circumstances of the Flax grower will influence him as to whether he should handscutch his Flax, or send it to where it can be scutched by machinery. Hitherto it has been generally considered that it is more advantageous for the small farmer and cottier to handscutch his Flax, and for the larger farmer to employ machinery, manual labour being too tedious and expensive where much Flax has to be scutched; but the increased facilities which are now being introduced into this country for having Flax scutched, owing to the construction of improved and portable scutching mills, as well as of those which have been recently erected in different parts of the country, will, there can be little doubt, make the practice of scutching by machinery that universally adopted in Ireland, whereby so great a saving will be effected in the time and labour consumed in this process where manual labour is alone employed.

THE COURTRAI SYSTEM OF MANAGING THE FLAX CROP.

In addition to the foregoing directions as to the management of the Flax crop, it may be well to notice here the practice which is followed with great success in some parts of the Continent, especially in that district of Belgium which is in the neighbourhood of Courtrai, and consequently that mode of treating Flax is usually designated as the Courtrai system. This consists in carefully drying the Flax in the field after it is pulled; and when this has been sufficiently accomplished, *it is*

ricked or stored up till the following spring, when it is considered fit for steeping. The chief peculiarity of this system consists in the mode in which the Flax is dried and ricked, which are accomplished in the following manner :—The handfuls of Flax as soon as they are pulled are set up in long narrow stooks, which are made by resting the tops against each other, the root or butt ends being placed on the ground spreading outwards like the sides of the letter A. These stooks are made from eight to ten feet in length, and a strap keeps the ends firm together. Being thus exposed to the action of the air and sun for six or eight days, according to the state of the weather, the Flax will be sufficiently dry to be tied up in bundles of the size of small corn sheaves; these are then made into a rick, which is usually constructed in the following manner: two poles are laid along the ground, parallel to each other, at a distance of about a foot apart, and in a direction north and south, so that the sun during the day may get on both sides of the rick; at the ends of each of these poles a strong upright one is placed.

The sheaves of Flax are then laid at right angles across the parallel poles, placing the tops and roots of each bundle alternately, and making the breadth of the rick the length of the sheaves; in this way it is built up to the height of about seven or eight feet, when it is finished by placing a single row of sheaves on the top lengthwise, or across the others, and then putting another row as before, the tops of all being placed the same way; by this means the necessary inclination or slope is given to throw off the rain; and being thus constructed, the rick is finally covered or thatched with a little straw, which is secured by a rope or otherwise. In this way the Flax may be safely kept for months, till it can be stacked or put in the barn; but in either case it is usual to remove the seed in the winter previous to the steeping of the Flax, in the spring, or early part of summer. Whatever advantages this system may possess, it certainly has this drawback, that a much longer time is required before the Flax is finished and ready for the market than where the system usually adopted in this country is followed, viz. of steeping the Flax immediately after being pulled. It is, however, a question whether the very superior quality of the Flax which comes from those parts of Belgium where this system is adopted may not in some degree be more or less connected with the practice of drying the Flax previous to its steeping, whereby certain changes are produced in the Flax, which render the fermentative action more slow and controllable during the subsequent process of steeping, and effect other alterations, whereby a fibre of better quality is obtained, which more than compensates for the longer time occupied in the process; at all events, the experience of the Flax growers of those districts where this system is followed, has no doubt shown them that, circumstanced as they are with regard to soil, markets of consumption, &c., this method of treating Flax is the most advantageous for them to pursue.

XXVII.—*Some Hints on the Successful Reclamation of Bog.* By GEORGE ELLIS, M.B.

[Read December 19, 1864.]

IT has been so frequently asserted, as if it were a generally admitted fact, that the bogs of Ireland are capable of reclamation, and by an outlay of money may be made to yield profitable returns, that, on the credit of this assertion, persons have been induced to commence drainage operations without due consideration, and have expended considerable sums in this way without arriving at the satisfactory results they anticipated. I speak here of those large tracts of pure unmixed peat bog used for the supply of fuel. Every one knows that on the flanks of most of these bogs, where the earthy material of the neighbouring land begins to mingle with the peat, there is a narrow border capable of remunerative reclamation, and this has been already effected in numberless instances by the occupying tenants themselves. But the reclamation I refer to here is of a more difficult character. First of all, after the general arterial drainage of the district, if that should be necessary, comes the thorough drainage of the bog: this, no doubt, may in general be pretty easily accomplished at no great cost, by skilled superintendence and a good supply of labouring hands, particularly if the sides and bottom of the drains are found sufficiently consistent for the use of tiles. Next comes what is called the gravelling, that is, the covering of the surface, to a depth of at least four inches, with the solid material found at the bottom of most bogs, usually in the form of a blue or yellow tenacious clay. There is sometimes to be had in this situation a calcareous marl, consisting chiefly of carbonate of lime, which is invaluable for the purpose; but, unfortunately, it is not always found in connexion with bog. This gravelling of the surface is considered an indispensable process; the cost will vary much with the locality; often the gravel must be raised from considerable depths by pick and crowbar, or carried from hills at some distance; and if in such cases the population be scarce, and labour consequently high, the owner should calculate carefully before proceeding further. In the absence of the marl I have mentioned, or of lime in some other form, the burning of limestone becomes a necessity; and if limestone cannot be obtained, I think he will be a bold and sanguine speculator who will undertake the reclamation. Let us, however, suppose that all the requisites I have mentioned are available, and that the surface is at last fitted for green crops, turnips, or mangels, and potatoes. The means of manuring well a large tract of this inferior soil must now be provided, and to some persons may prove a serious difficulty. Let us now proceed still further, and suppose that the green crops have grown satisfactorily, and that they have been succeeded by oats or rye, with grass and clover seeds. At the present price of grain, I need not dwell on what the value of this crop will be after deducting the cost of labour; the grass, however, which follows will be found highly valuable in supplying hay for winter feeding, and afterwards as

pasture for young cattle of a light description. For the next three or four years the expenditure for labour will be very trifling, little more than what is required to keep fences in order, open drains clean, and for the general care of young stock. This period will be found satisfactory to the farmer's pocket, and if this state of affairs were only permanent, the reclamation of the bog would be decidedly successful; but now comes perhaps the greatest difficulty of all; after a few years the grass begins to fail, the whole rotation must be recommenced and gone over again—green crops, cereals, grass, and clover—with equal expenditure as at first for labour, manuring, and liming, and the farmer will now begin to reflect, and calculate his profits.

Having made these preliminary observations, I will now relate, with your permission, the history of a piece of reclamation of this kind on rather a moderate scale, which was completed about fourteen years ago, and has proved up to the present time fully remunerative.

There is on the sea coast of the country of Leitrim a limited district, remarkable chiefly for its numerous and poor population. For the greater part of a century they had been allowed, like many others similarly circumstanced, to subdivide their little holdings much as they pleased, as they always paid their rents without much difficulty, and they increased and multiplied accordingly. The population of one large townland there of about 670 acres, including much bog in which the reclamation I refer to has been carried on, was by the census returns of 1851, after the famine had done its worst, 479, males and females included. In the spring of 1849 distress was at its height; the people were reduced to the last extremity, and the owner was much perplexed. Two courses were open to him: by simply waiting, with a little pressure and a small outlay of ready money, this starving population might have been made gradually to disappear, their homesteads might have been unroofed as in other places, and the land, which is of excellent quality, turned into pasture; or, the owner might sympathize with the struggles for life of the sufferers, allow them to remain in their holdings, and, by providing employment, furnish them with the means of assisting themselves by their own labour. Fortunately the latter course was taken; a grant of £900 was obtained under the Land Improvement Act, and work was soon commenced. Besides the thorough drainage of some good land which required it, and of which I shall not speak further, there was taken in for reclamation a tract of about 90 acres of bog, partially cut for fuel, black, barren, and useless for any other purpose; and to this portion, as bearing on the subject of this paper, I shall now confine my remarks.

The operations of levelling, thorough draining, gravelling and fencing, were effectually performed under the periodical supervision of the Commissioners, who, through their able inspector, Mr. Prendergast, afforded every facility and assistance for the period of three years, during which the work lasted. The tenants on the land were, I need not say, quite numerous enough to supply the requisite amount of labour, and soon, under skilful training, became adepts in the art of reclaiming.

Fortunately the stiff yellow clay at the bottom approached the surface, here and there, and furnished the means of gravelling sufficiently, though this part of the work was slow and laborious. Limestone is found here on the rocky coast, and a large limekiln was soon erected. Each field, on being completed, was prepared for a turnip crop. The only manures used were seaweed and some turf ashes obtained by paring off the coarse and rugged surface of the peat, and burning it in heaps upon the field, the gravel being carefully removed when this was done. Considering the cost of this simple and primitive mode of husbandry, there was no cause for being dissatisfied with this the first year's crop, particularly as the main object in these cases is to bring the soil into a state of preparation for laying down with grain, grass, and clover seeds,—an object which was accomplished, in the first reclaimed portion, the following year. By a liberal supply of lime, after a fair crop of rye the clover grew well, and the grass surpassed expectation. The well-known fiorin grass, *Agrostis stolonifera*, was found to grow luxuriantly and was easily propagated by cuttings. A large crop of hay was secured, and young cattle afterwards placed on the pasture. During the three following years the annual outlay for this portion was at its minimum. The cattle throve well, and the profit from their sale was considerable.

If, by the simple processes I have described, waste bog could be converted into permanent pasture, there would soon be very little of this commodity, thus favourably circumstanced, left unreclaimed in Ireland. Nature, however, will have her way. After the third or fourth year the grass in the fields first laid down began to fail, and the soil required to be turned up again.

Now, whether in a series of years this rotation would remunerate the owner fairly, considering the low price of grain, and the ready money expenditure necessary for all labour (including the gathering, carting, and spreading of the seaweed, and all other requirements for this kind of tillage farming), I have had no means of ascertaining experimentally; as at this period a new arrangement was made, by which the same system of rotation was carried into effect with very little expense to the owner; and to this new arrangement I wish particularly now to invite attention.

The potato disease was at this time very destructive to crops planted in clay land; while it began to be noticed that bog soil seemed to have some preservative quality, which protected at least a considerable portion of the crop. Some of the men were anxious to make trial of it; and, in compliance with their wish, those fields where the grass first began to fail were submitted to the experiment. Each field was marked out in roods, which were apportioned to those who desired to take them for the season's crop, or, as it is called, in conacre. Each man manured his rood plentifully with seaweed; and the potato crop which followed was the best and safest that had appeared in that neighbourhood for many years, while the clay land adjoining suffered in the usual way. The conacre rent, at the rate of £3 the Irish acre, was cheerfully and

well paid; the only outlay by the owner, for this year, being the cost of supplying lime, which, however, also served him indirectly, by improving the condition of those tenants who were employed in the collecting and burning of the limestone. The same fields, in the following year, yielded equally good potatoes at the same rate of rent, without any further addition of lime; and in the third year they were again laid down by the owner with oats, grass, and clover seeds, yielding, as before, after a grain crop which was not considerable, an abundance of hay and good pasturage.

Successive portions of the rest of the bog were treated similarly, and up to the present time the same rotation and system of conacre have been observed, with satisfaction and benefit to employer and employed. In fact, this piece of waste bog alone, by the treatment it has undergone and the system adopted, may be considered a permanent improvement, returning to the owner, for the outlay of about £500, a clear addition of at least one hundred a year, besides no inconsiderable benefit to the numerous small occupiers residing on the property.

Now, I think it is pretty evident that the system I have described is only applicable under certain conditions, and that these conditions present themselves only in certain limited areas, occurring only on those parts of the coast where the population is very numerous, where lime is easily obtainable and seaweed abundant, and where bog is found of such a nature and position as to admit of thorough drainage and good gravelling, at a moderate cost. I believe that much disappointment has arisen from undertaking the reclamation of bog not possessing these advantages; and that much money has already been spent in futile attempts to render such bog reproductive. In one large estate, belonging to a distinguished nobleman, whose liberal efforts in this way are to be admired, many thousand pounds must have been expended and utterly lost in bog reclamation. He has, however, enabled a great number of small holders to emigrate; and, by planting and thorough drainage of large tracts of poor and sour land, has effected a visible improvement in all that part of the country; but the bog on which so much money had been wasted has already returned to its original condition, and will, perhaps, remain bog to the end of time.

I do not express an opinion as to whether that mode of improvement may not, in the end, be more beneficial to the country generally. Under the circumstances, I believe nothing better could have been done in the instance referred to. All I desire to affirm is, that on certain parts of the Irish coast, where there exists a sort of local plethora of population, and where tracts of useless bog are found in connexion with such natural advantages as limestone and seaweed, there this numerous population, instead of being an obstruction and a difficulty, may be utilized, and treated as a chief element necessary for the profitable application of such natural advantages in the reclamation of these otherwise useless wastes. As a relief to this local plethora, this method will certainly be found more agreeable to all parties than the otherwise perhaps unavoidable one of blood-letting, as it may well be called, and purga-

tion—the forcible removal of a superabundant small tenantry by process of ejectment, combined with the expenditure of pecuniary inducements besides.

Unfortunately these crowded populations are found to be prolific in the ratio of their poverty, and after a few years the increase of births over deaths furnishes a new difficulty, not easily dealt with. I am glad to say that in the district I speak of a disposition has shown itself among the young people to seek employment in the great manufacturing towns of Scotland; Glasgow appears to be the favourite resort of the more adventurous, and I have little doubt that after some time, by the spread of education, and increased facilities of communication by railway and steamboat, an effectual drain shall be established, which will keep the pressure on the land, even in the most populous districts, at a safe and endurable amount. The rail, the steamboat, and education seem destined to become the true elevators of the lower strata of our social life. If manufactures do not come to us, we at least can go to them, and we can lose nothing, while we gain much, by the freest intercourse and closest union with the sister island.

But there is one kind of manufacture still left to us everywhere in Ireland in which we need not fear competition, and which, if developed as it ought to be, and I think must be finally, will perhaps enable the small occupier of five Irish acres to live and thrive, and upset the theories of those high and respected authorities who consider thirty acres the minimum on which an Irishman ought to live; and as it seems to me to have a connexion not very indirectly with the subject of this paper, I may be pardoned for dwelling on it a little, in conclusion.

I think it is now tolerably manifest, from the experience of many years past, that Ireland as a corn-producing country can never again enjoy a very profitable market; grain has fallen below remunerative prices, and, unless in those exceptional years when there may occur a general scarcity in Europe and America, must always continue very low. Free trade, as we all know, has accomplished this all-important result, with immense benefit to the interests of Great Britain and of the world; and, though inflicting immediate injury on the Irish farmer, will ultimately, I have no doubt, conduce very greatly to his prosperity. It may be also assumed, I think, that all the other vegetable produce of the tillage farmer in its raw state, if sent to market in that condition and sold, if that were possible, at the market prices of the present day, would never very much enrich the producer. Yet the small holder is now surprised and bewildered, because with his potatoes, and his oats, and the pig, his only animal production, he finds the difficulty so much greater now than formerly of feeding his family, keeping out of debt, and settling with his landlord.

But the grazier is now the thriving man. Unlike the tillage farmer, he converts *the whole* of his raw vegetable materials, grass, hay, and green feeding, into animal products, and is always pretty sure of a ready sale at good prices. In these articles of consumption, with the best markets in the world, the great manufacturing and commercial

towns of Great Britain, always close at hand and always open to him, he need never fear foreign competition. Now, *if improvement is ever to take place in the condition of the small holder, I think its direction is thus plainly indicated to us.* There is a great variety of animal substance into which *the whole* produce of a small farm (flax of course excepted) might be converted. Besides the indispensable pig, with its numerous litters, there is the sheep with its wool; butter, of course, always now profitable; poultry of all descriptions, with their eggs and feathers; and, above all, the breeding and rearing of young stock, to be afterwards transferred to the grazier's hands. For the production of all these marketable articles there is also a great variety of vegetable substances, of some of which the small holder has hitherto had little experience. There are the great flesh-producers, the bean, the pea, the vetch, and the clover; there are the mangel, the turnip, the carrot, the parsnip, and the cabbage, as well as the potatoes and oats. We are familiar with the fact that even a small garden may be made by skilful treatment to yield, in proportion to its size, a great quantity of these vegetables; and surely a farm of from five to ten acres of good land in the hands of an industrious man, with a large family of healthy children (the larger the better), ought to give full employment, under this system, to his whole household at all seasons of the year, and amply repay all the labour expended on it. The manure would return much of the produce to the land. The breeding and rearing of young stock would be the specialty of the small holder; the difficulty of supplying this prime necessary to the grazier would not then be felt as it is so severely at present, and butcher's meat would probably be manufactured with profit at a price that would enable Ireland to exclude the foreigner from the British markets by a sound, healthful, and legitimate species of manufacture peculiarly her own.

The difficulty of introducing any new method so opposed to long confirmed habit would, no doubt, be great. To leave the supply of the grain market entirely to those foreign nations, who are able to produce a better and cheaper article than we can, may appear, indeed, sufficiently in accordance with common sense; but the substitution of animalized products will require so much more industry and unremitting attention than the old plan, that any advance in this direction must be slow. The necessity for the erection of sheds and enclosures would be another obstacle to the small farmer, but I need not enter into details. I have only introduced the topic here as a theoretical opinion, in the hope that practical men, having large experience, and a close acquaintance with Ireland and its people, may be induced to turn their attention to the improvement of the small holder in this or some other better direction, and perhaps to give us the result of their experiments at some future day.

XXVIII.—*Suggestions for the Amendment of the Arterial Drainage Laws.* By WILLIAM LANE JOYNT.

[Read Monday, November 21, 1864.]

To any one acquainted with the industrial resources of Ireland, with the impediments to its prosperity, or the advances effected for the last quarter of a century, there can be no more interesting chapter in our history than that which is told in the successive Reports of the Drainage Commissioners from 1842 to 1846, and of the Board of Works from the latter period up to the present.

But it was not in 1842 the suggestions for the improvement and drainage of land first arose. The reclamation of the waste lands of Ireland has often attracted the attention of the Members of the Royal Dublin Society. The unemployed resources of the country had appealed alike to the statesman, the traveller, and the patriot: and all were equally concerned to see the means of profitable employment for the people neglected, and the sources of new revenues untouched.

The annals of the Irish Parliament, as early as 1715, show the attention the subject then received. In 1777–8–9, Arthur Young investigated it. The Reports of the Bog and Waste Lands Commissions of 1810, 1811–14, the Devon Commission, in 1843–6, and the various debates on the subject in the House of Commons, have exhausted the whole field of inquiry. My intention, however, is not to discuss the question of the waste lands of Ireland, but to direct your attention to the rich and fertile lands of the country which occasionally, or for the greater part of the year are wet and flooded, which are rendered almost useless by this overflow, and which, more fatally still, prevent the thorough drainage of the surrounding districts.

In 1831 a bill was introduced into Parliament, and its preamble is couched in language forcible and felicitous:—

"Whereas it has been ascertained, as well by the Reports of certain Commissioners appointed under the authority of Parliament in the year one thousand eight hundred and nine as otherwise, that there are throughout Ireland, contiguous to the banks of rivers, and streams, and lakes, many large tracts of lands, some covered with water for not less than half the year, some periodically flooded, and others subject to frequent damage and inundation by reason of the defect of embankments and interruptions in the channels of such rivers and streams: And whereas the said tracts of lands comprise generally the finest alluvial soil, and, although in their present condition of little value, would, if protected against inundation, become productive and fertile in an eminent degree: And whereas the reclamation and protection of such lands would be advantageous to the proprietors thereof, and would conduce to the health of such districts, and afford beneficial employment to the distressed labouring poor; but by reason of the various modifications of interests and estates in such lands, and the legal incapacity of persons having such interests, and the defect of co-operation

in them, the same cannot be accomplished without the authority of Parliament."

The preamble is the best part of the Act; its cumbrous machinery of joint stock companies and loans on debenture could never carry out the arterial drainage of the country; and it remained on the statute book a monument of unfulfilled intentions.

In 1842 the first great attempt was made to establish the Drainage Laws on a practical and useful basis: that attempt presented a feature without a parallel in any country, namely, in the regulation of the great proportion of its water-courses or main drains from their sources to the sea under an organized system of voluntary co-operation, at the expense, equally distributed, of the interests, whether public or private, benefited by the operations.

The two great systems of drainage in Ireland for which there are separate acts and modes of procedure are the arterial system as applied to rivers and water-courses, and the thorough drainage as applied to various estates throughout the country. One may be called the public, the other the private system; but both are more required in Ireland than in any other agricultural country in Europe, from its geographical position, the humidity of its climate, the almost level character of the great but not elevated plains of the centre of the island, and the wonderful extent of the country under, surrounded, or penetrated by water. The thorough Drainage Acts, so far as I know, require but little amendment, and to them on a separate occasion we may call attention.

The leading principle contemplated by the whole code of the Drainage Laws was that the measure in each instance should be successful, provided the resultant benefit on an average of years would be commensurate with the cost.

The Act 5 & 6 Vict. cap. 89, entitled, "An Act to promote the Drainage of Lands and Improvement of Navigation and Water Power in connexion with such Drainage in Ireland," received the royal assent on the 5th of August, 1842; and its provisions constituted the Board of Public Works, with such additional Commissioners as the Lords Commissioners of Her Majesty's Treasury should appoint, Commissioners in the execution of said Act.

Its objects may be divided into the following classes:—

1st. Drainage of flooded and injured lands along lakes and rivers, and wastes in the interior of the country, combined generally with some alterations or improvements in water power.

2nd. Drainage and embankment of lands from the sea and tideway, combined with the improved drainage of adjacent lands partially embanked or drained.

3rd. Drainage of lands in conjunction with navigation.

4th. Mill-ponds, improvement thereof by formation of reservoirs for the conservancy and constant supply of water.

Let us rapidly notice its leading provisions.

Persons interested in any lands liable to be flooded or injured by water, or the drainage of which might be capable of improvement, were at liberty to memorial the Commissioners of Works; and on the presentation of such memorial, the Commissioners directed some engineer or other competent person to make a survey of the land or river referred to in such memorial, and to inquire into the state of the river, and the capacity of the land for improvement by drainage, and the probable increase in the value of such lands when so improved, and also the capacity of such river for improvement. By the subsequent sections, on the receipt of such report, if the Commissioners should consider that the benefits likely to arise would be commensurate with the probable cost of the necessary works, or if the Commissioners considered it expedient that such works should be undertaken, then the report should be deposited for six weeks with the clerk of the peace for the county where such district was situate; a notice was then to be published that maps, plans, estimates, had been lodged, and subsequent thereto a meeting of the proprietors of the land to be drained was ordered to be held. At such meeting all objections to such plans, schedules, and estimates, were to be heard by the Commissioners, and two-thirds or more in extent of the proprietors of the land proposed to be drained were required to be assenting parties to the undertaking, otherwise the works could not go on. Under the 33rd section, the Commissioners were to make a declaration; and this was a most important and useful document, altogether omitted from the Act of 1863, which was in fact to be an amended schedule, plans, and a history of the whole proceeding. Notice was to be given of its lodgment; an appeal lay to the assistant barrister; and when this was heard, all the preliminary measures and proceedings were taken; the Commissioners were to give final notice thereof, published in the Gazette, and some local newspaper, and thereupon no question or appeal could lie against the acts of the Commissioners, save by a petition to the Court of Chancery or Exchequer. After the publication of the final notice, the Commissioners were at liberty to commence the works (section 40), and to appoint officers (41). The 99th section empowered the Commissioners to borrow money, and to grant certificates on the security of the award to be made as therein directed; and it empowered the Commissioners to borrow money for the execution of the works from the Public Loan Commissioners, and from the Commissioners of Public Works.

By the 106th section, the Commissioners were to make an award on the completion of the works, describing the land or river so drained or improved, the works completed, the quantities belonging to the reputed proprietor, the original and increased value of the land, the amount expended in and about the works so executed, the interest on all borrowed moneys, whether the same was to be paid in one sum or by instalments; and if by the latter, to specify them, and the costs and charges of the future maintenance of said works. Objections were to be heard to said award; and after its final settlement, it was to be filed

in Chancery, and to be then law, so far as all parties interested were concerned. The money for the works, with interest at 5 per cent., was to be charged on the lands so improved, and on any other land situate within one mile of any part of the land so drained or improved.

The 120th section directs the mode of appointing trustees of the districts where no navigation was included, or reservoirs constructed; and these trustees were to decide the amount to be raised for the maintenance of the works, and to hold meetings, and transact the business of the district.

The 147th section directed that the Solicitor of the Board of Works should do all the professional business necessary under and by virtue of the Act.

Thus the Act provided for the making of two surveys, and the publication and lodgment of documents emanating from both. The first may be termed, according to the arrangements made by the Board of Works, the engineering survey; and the other, territorial survey and valuation of the various holdings and estates in the district of lands to be drained, comprising the ascertaining of the names, titles, and tenures of the various parties interested.

The Second Report of the Drainage Commissioners states—"The policy of the Act is to give the greatest possible publicity to every proceeding, and to afford ample time to every person who is in any way interested in, or affected by, the measure, to consider its details, the means by which it is to be effected, and the probable results, together with a power to submit their objections to the Board; and, if dissatisfied with our decision, to appeal. For this purpose, numerous notices are required to be published, long periods fixed for the lodgments of the plans, schedules, and other documents, and ample time for appeal to the quarter sessons afforded."

They go on to say—"The opening of the rivers and main ducts of the country is the first step, long required towards its improvement in drainage, and the reclamation, not only of waste lands, but of some of the most naturally fruitful soils in the country; this important step the Act offers perhaps the first reasonable prospect of accomplishing, and with it the concurrent advantages of some improvements in navigation and water power, whilst means will be afforded for extensive subsoil draining, by opening the outlets from low grounds; and even improvements in the climate may reasonably be anticipated from the operations of the Act, if extensively worked."

Such was the general scope of the first great Drainage Act for Ireland. It was unique in its combinations; it was involved in legislative and administrative difficulties of no ordinary character, and required great delicacy and good management in its execution.

The legislative difficulties arose from the numerous and conflicting interests concerned in the drainage, and, above all, from the rendering necessary the voluntary act *of a specified majority*, binding on the *minority of the proprietors.*

It was no small or easy thing to find the requisite professional skill—the physical knowledge required in designing, and the training of engineers. It required, moreover, the free, uninterrupted provision of pecuniary means to meet the outlay and all contingencies, and to proceed with the works at the times and seasons most suitable for the purposes.

The Commissioners adopted the practice in each case of publishing the preliminary report of the engineer employed, with a diagram, map, and section, illustrative of the project; and thus the fullest opportunity was afforded to every one interested in each drainage district of investigating the subject before the measure was undertaken.

Let us now see what was the state of the lands before the works commenced in 1844. The Report of 1844, p. 7, states:—

"The present state of the lands in the drainage districts of the several classes now described is so bad as generally to excite astonishment (in persons unacquainted with the want of means to produce co-operation), that more energetic attempts have not been heretofore made to reclaim them, especially as they are known to be, with few exceptions, amongst the richest and most productive soils of the country. The value of the lands has been, generally speaking, gradually decreasing, the causes of injury increasing with the improvement of the country around them, whilst the obstructions, natural and artificial, remain the same, or are increasing also. In many districts the lands are subject to frequent inundations in each year; and often, at harvest time, such crops as may have attained maturity, are subject to be destroyed; in some districts the lands are rapidly becoming marshes, the waters seldom subsiding even in summer below the level of the surface of the ground.

"Few attempts have been heretofore made for the improvement of lands so circumstanced, and these almost invariably of a partial kind; new cuts and embankments along rivers have been made in some districts by individuals to relieve themselves; but from such works not forming any part of a general system, the new cuts have been generally found to aggravate the evil, by dividing and lessening the scouring power of the river, whilst the embankments made to guard the lands under the state of circumstances existing when they were made, become insufficient, the level of the river becomes raised above the adjacent lands, and in a few years the floods overtop the banks, and they produce even greater devastation and loss of property than before."

From 1844 up to 1846 several districts were undertaken, and great confidence inspired in the labours of the Commissioners; but the potato famine and all its terrible consequences then fell on the country, and a great cry arose for additional employment for the labouring poor.

The result was an amended Act, 9 Victoria, chap. 4, usually called the Summary Proceedings Act, which was passed by the legislature early in 1846, and by which greatly increased facilities were afforded

for carrying into effect the provisions and principles of the original Act :—

1stly. By sanctioning an advance of money from the consolidated fund to meet the cost of preliminary inquiries.

2ndly. By the increased and permanently fixed security afforded for moneys to be borrowed for carrying out the works.

3rdly. By a curtailment of the preliminary forms required by the preceding Act, which involved great expense.

4thly. By a reduction of the quantum of assents of proprietors from two-thirds to a simple majority in quantity of the lands to be improved, and also further amendments as regards navigation and formation of reservoirs, or improved mill power in conjunction with drainage; and,

Lastly. By providing that no greater amount than £3 for every statute acre should be expended under it, unless the assents of the proprietors should be given a second time for the further execution or final completion of the works.

This question of second assents was the source of fruitful trouble: no doubt it was introduced into the summary proceedings as a safeguard, but it was taken advantage of subsequently to arrest the works, to dispute the awards, to deny the improvements effected, and partly led to the inquiry before the House of Lords, in 1852, into the operation of the Acts relating to drainage of land in Ireland. Upon the Report of the Lords, Special Commissioners of Inquiry into the state of districts where disputes arose were appointed, and we shall hereafter notice their recommendations.

We have now explained the legislative powers conferred by the two Acts which really formed the drainage code; let us next consider the obstacles to their being successfully carried out.

The impediments in the way of the due execution of the works, the apathy or hostility of many interested, the ignorance of the parties employed, the atmospheric and climatic difficulties and impediments, can only be estimated by those who were engaged in the works from their commencement in 1844 up to 1857.

Moreover, the periods over which a great part of these works was spread were those years never to be forgotten in Ireland, when the famine was sore in the land, and the pestilence walked at noonday; these causes demoralized the people, rendered them very unfit for work, and impeded the success of the Commissioners' labours.

Previous to the drainage works in Ireland there existed but little data upon which the calculation and designs for river courses to unwater large tracts of country could be safely founded; and although the average fall of rain in some parts of the country had long been recorded, yet it was but a slight and uncertain indication of the fall upon which mainly depended the magnitude of floods in rivers and streams. The Board's engineers collected such information.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Another difficulty of much consequence lay in the path of the Commissioners, namely, to decide whether the deep or shallow system of arterial drainage was the better. The proprietors held that works adequate to protect against ordinary floods would be sufficient, while the department maintained that it would not be possible to fix the capacity of a channel which would just accomplish the object of allowing the lands to be occasionally flooded in the winter season, and prevent such an occurrence in summer, when it would do harm. The Commissioners asserted that half works of the drainage class are the most expensive that can be invented.

This question of the deep or shallow system is closely connected with another source of much difficulty—the estimates for the works. In nearly all cases the estimates were insufficient—perhaps no other cause contributed to the unpopularity of the Board of Works so much as this—perhaps none admits of more reasonable explanation; and certainly the decision of the Commissioners of Special Inquiry, that the excess of the expenditure over the estimates in the eleven districts inquired into by them should be remitted, was at once generous in its result towards the proprietors, without in any way reflecting on the parties who felt the excess to be necessary, and above their abilities to control, under the extraordinary powers conferred on them by the Summary Proceedings Act.

The cost of the works could not be fairly found fault with—they were executed at less prices than the railways of Ireland, generally given out by contract, and less than the Shannon Navigation works, given out by the Commissioners themselves by contract. (See Report, August 8th, 1852, p. 45.)

The system of task work was introduced by the Board with the best result; and its advantages are fully set out in the 4th Report, pp. 11 and 12; but the Commissioners of Special Inquiry in 1852–3 lay down as a principle, that, had there been time enough to do so, such works should have been done by contract.

The great and conclusive test of the drainage operations in each district was the final award, in which the total expenditure had to be compared with the beneficial results produced, and the improvement of the lands tested and valued.

The lands so relieved were the rich alluvial soils of the country, flooded from three to six months of the year, yielding precarious crops, in some cases, nearly valueless, from the height in which the waters were retained even in summer; whilst in others, such as land reclaimed from the sea, or lakes wholly drained or cut out of bogs or marshes, the extent of the land drained forms an absolute addition to the fertile producing power of the country.

The whole of these lands afforded little or no employment, and, from their flooded state, were injurious to the health of the inhabitants; but since their improvement, the best results have been discernible.

What, then, were the results? When inspected, it was found the

crops were greatly improved in their quality, the lands rendered available throughout the whole year, either for grazing or the labours of the agriculturist, and in many cases employment afforded in operations of deep under or thorough drainage, where it would previously have been impossible to till the lands; in many others, works of cultivation, reclamation, and tillage undertaken in lands that could scarcely be grazed in summer; and in almost all cases there was evidence of the amply remunerative nature of the undertaking.

In estimating that increase in the value of lands which might be expected to result from the execution of the works proposed, the Commissioners calculated only the difference between the fair letting value when so improved and their former actual value as the basis of their calculation, and from this they calculated the return upon the expenditure.

Having so far sketched the history of the drainage operations, the legislative powers conferred, and the difficulties impeding the Commissioners in the execution of the works, we will now approach the results accomplished, and the expense incurred.

A return made to the House of Commons, on the order of Viscount Duncan, in 1857, gives the following results:—

1st. The lists of Arterial Drainage Districts in which final awards had then been made—these amounted to 105; the area of their flooded or injured lands which had been drained or improved was 160,572 acres, 2 roods, 7 perches, statute measure; the total expenditure thereon was £926,106 18*s*. 9*d*., which included all the cost of works, local staff, purchase of lands, mills, and fisheries, compensation for temporary damage, and interest on the borrowed moneys. This last item was a very heavy one, amounting at the date of the Report to £159,166 7*s*. 11*d*.

The amount charged to the proprietors of the lands improved was £519,733 16*s*. 2*d*.; to counties, for roads and bridges, £45,204 8*s*. 1*d*.; and the amount then remitted by the Government was £360,426 13*s*. 6*d*.

The second return contained a list of sixteen districts in which the works were then commenced, but the final awards were not made. But as these have been nearly all since finished, we shall notice hereafter these districts in the total of the works completed up to 1864.

That will be found in the 32nd Report of the Board of Works, 1863, and shows that, on 123 districts, a total expenditure for all purposes of £2,384,333 8*s*. 11*d*., the portion charged to counties for public works was £151,993 14*s*. 9*d*.; the portion of total expenditure charged on lands was £902,148 13*s*. 6*d*.; the remissions were £1,190,560 13*s*. 1*d*.; area of the catchment basins of the lands improved was 6,358,358 acres; the area of the flooded lands which had been improved was 266,736 acres, 2 roods, 4 perches, statute measure; average cost per acre, including interest, was £8 11*s*. 4*d*. But the cost per acre, deducting the remissions, is only £5 19*s*. 11*d*.; and even this includes heavy navigation works; the increase in the annual let-

ting value of the lands was £74,502 7*s*. 2*d*.; and the total repayments on foot of the advances (less the remissions) was £686,387 17*s*. 4*d*.

Now, this return explains itself, and requires no comment. One only we will make on it, and that is, that the repayments are a strong indication that in any future advances the Treasury may make, the sums so lent will be duly repaid.

We will come back to the 3rd Table in Viscount Duncan's return, which relates to the navigations combined with drainage.

The length of navigation opened by these works was 222½ statute miles; and as the other details, save that of the Hind River, are included in the second return, we need not further refer to it.

In the return No. 4 we have a total of eighteen districts, for which final notices were issued, but in which the works were not then (1857) commenced.

None of these districts have since been undertaken. The area of their catchment basins is 390,877 acres statute measure; the length of river or main drains to be improved is 81⅛ miles; and of the flooded lands, 16,122 acres, 0 roods, 12 perches, statute measure; the estimated increase in the annual value was £6,122 1*s*. 1*d*.; the estimated cost of the works was £69,472 2*s*. 11*d*.; and the amount of preliminary expenses was £1,902 6*s*. 1*d*.

One district only of these (a small one) was executed by the Marquis of Sligo, and transferred to the Landed Improvement Act. "The others were all discontinued, from want of funds, and subsequently, by the Treasury order against undertaking new responsibilities."

The return No. 5 shows the list of Arterial Drainage Districts for which memorials were presented to the Board of Works, and in which preliminary surveys were commenced, but not completed.

Part I. contains seven cases of ordinary proceedings in which reports have been published, but the preliminaries were not completed, nor the works commenced.

The area of these catchment basins is 1,584,020 acres; length of rivers to be drained, 536 miles; area of the flooded lands, 96,370 acres, 1 rood, 24 perches; estimated increase of annual value of the lands, £23,063 17*s*. 1*d*.; the estimated cost of the works, £417,766 16*s*. 10*d*., and the expense of the survey, £3,070 12*s*. 2*d*.

One of these districts, of which we heard so much recently, is the Suck River. The memorial is dated 2nd September, 1846; the area of its catchment basin, 400,640 acres; length of river, 438 miles; area of flooded lands, 72,337 acres, 2 roods, 6 perches; estimated increased annual value of the lands, £13,275 2*s*. 4*d*., and the estimated cost of the works, £242,060. We shall refer to this district again.

Part II.—Return No. 5 shows four cases of ordinary proceedings in which no reports were completed, published, or the works commenced.

One of these is the Barrow District—one of the finest in Ireland—containing 204 miles of river and main drainage. An effort is now

making to commence the preliminary proceedings under the Act of 1863, but we have learned it has been abandoned.

Another district is the Navigation of the Lower Bann—a measure which the inhabitants of Coleraine feel a deep interest in, and for which they recently have obtained special parliamentary powers.

Part III. contains forty-two cases of summary proceedings in which reports are published, but preliminaries not completed for want of assents, including also rejected cases, and cases postponed at the request of proprietors.

The whole of these forty-two cases cover an area of their catchment basins of 3,627,516 acres; an extent of 355¼ miles of navigation; an area of 56,070 acres, 2 roods, 37 perches, of lands proposed to be improved; the estimated improved annual value of the lands, £22,046; the estimated cost of the works, £290,151 18*s*. 2*d*., and the amount expended in the surveys is £2,609 18*s*. 9*d*. Of these several are districts of great value.

Part IV. of the return contains a list of 236 cases in which no reports have been published, nor the preliminaries completed, by reason either of their magnitude, or the orders of the Treasury to suspend all further preliminaries.

Now, it is undoubtedly true that some of these applications were rejected because the works were not likely to repay the expenditure on them—others, for informality in the memorials; some are included in the districts already done; some were not entertained for reasons not stated; and, above all, most of them were put off by reason of the alarm felt by the Treasury in 1848, at the great and gigantic extent to which the districts and expenditure were rapidly moving. *But it is not too much to say that at least as much more of arterial drainage in Ireland remains to be done as has been accomplished.* No doubt many of the most pressing cases were those which were carried out at first; *but those which yet remain to be done, and upon which the thorough drainage of the adjoining estates depends, are of national importance and urgency.*

How, then, is this work to be done? It will be readily answered, under the Drainage Acts of 1863. Let us, therefore, consider what facilities they offer; in what respect they differ from the Acts of 1842 and the Summary Proceedings Act of 1846, and how they can be amended? Before, however, we proceed to do this, we must retrace our steps, to review the controversies between the Irish proprietors and the Board of Works.

These did not arise until after the passing of the Summary Proceedings Act in 1846; and the correspondence published by Parliament in 1847–8–9 shows very plainly the grounds of complaint. The excess of the expenditure over the estimates arose principally from additional works, and the extension of the area to be drained, from the fact that the estimates for the works, to which the proprietors had in the first instance assented, had been made hurriedly, and were found in many cases to be wholly inadequate to complete them. One hundred and one

districts were surveyed, and estimates made, between the months of May and October, 1846. Disputes also arose as to the superiority of the two systems of deep and shallow drainage.

So successful were the first works undertaken, and so definite and satisfactory were the principles laid down, both as to estimates and valuations, that the public gradually acquired confidence, and the applications for preliminary surveys became rapidly more numerous and more important.

From 1842 to 1848, matters went on smoothly enough; but in the latter year the Treasury became alarmed at the outlay; they directed no more works to be undertaken, and that those commenced should be completed rapidly.

The letter of the Chairman of the Board of Works, dated 21st December, 1849, indicated that much of the works would largely exceed the estimates; and another return, in the January following, showed that out of the 106 districts then commenced there was an excess over the estimates in sixty-one cases.

In the return of September, 1851, it appeared that the estimate of the works then unfinished was £1,179,374; the new estimate was £1,863,168, of which £683,794 was still required to complete the works. Looking to the past, one-third should be added to that, and the amount then to be expended was calculated at one million sterling.

It was asked, and not very satisfactorily answered, what right had the Commissioners in charge of the Drainage Department to throw aside the plans and estimates assented to by the proprietors, enlarging the works, making additional works, extending the area to be operated on, making outfalls for the deep instead of the shallow system of drainage, all charges attended with a heavy additional cost, without consulting the proprietors who were to pay for the works? Sir Charles Trevelyan said, the Commissioners were trustees for the mortgagees as well as the proprietors; and that so long as they acted in good faith, and did not come to a decision until the hearing of all parties, they were not exposed to censure. Mr. (now Sir Richard) Griffith said, he would have felt it his duty to consult the proprietors; and Major (now General Sir Thomas) Larcom's evidence leads to the same conclusion. Upon a full perusal of the evidence, we must admit that this action of the Drainage Commissioners was beyond their legal powers. The fiftieth section of the Summary Proceedings Act negatives the whole theory; for it required the second assents to be given when the expenditure exceeded £3 the statute acre. The Committee of the Lords in 1852 investigated the subject, and the evidence given before them is of the most interesting character, and they suggested that a special independent inquiry should be directed; and accordingly, in 1852, the Commissioners of Special Inquiry—consisting of Sir Richard Griffith, Sir William Cubitt, and Mr. James M. Rendal—recommended that the only just settlement of the question was to limit the contribution of the landowners to the original estimates of cost, and to complete the works at the charge of the Public Exchequer. The remissions thus made in the eleven districts

reported on were £106,616 8*s.* 10*d.*; the total sum to be expended by the proprietors, £186,916 5*s.*; and the total cost of the works, £293,532 13*s.* 10*d.*

We must confess that, on reading over the Report of the Commissioners of Special Inquiry, it left upon us the impression of harshness towards the Drainage Commissioners; it took little or no note of the difficulties by which they were surrounded, and did not notice the all-important fact, that, while they were expending the Drainage moneys, an expense of a far greater and more disastrous character was going on throughout the whole country—namely, £5,500,000 on relief works, exclusive of what was being expended by the Food Commissioners and the Poor Laws.

All these matters were at length adjusted; the districts commenced were finished; the Government allowed the excess of expenditure over the estimates to be remitted; but the ill effects of the quarrel between the proprietors and the Board of Works have lasted to the present hour. The proprietors accused the Board of excessive expenditure, of acting without consulting them, of over-estimating the good effects of the drainage, and of undertaking unnecessarily, in the awful times of famine and distress, and at a time when the price of land itself fell fifty per cent., complete or perfect works, which would be as useful if done on the shallow or half system of drainage.

The Board and its officers felt animated by a strong desire to improve the country, to exercise their extraordinary powers with a single view to that end; but they felt they were thwarted and opposed by the proprietors, in many cases indifferent to any improvement, unwilling even to pay for it when effected, and captious because a single central Board in Dublin, in times of famine, and with a cry for employment ringing in their ears, could not carry out great works at as cheap a cost as a local proprietor in many cases could no doubt effect trifling local works for. And this sense of hostility on the part of those proprietors who resisted and roundly abused the Board of Works has led to an entire change in the Irish Drainage Laws.

For, instead of the Board of Works being directed to carry out these works with the saving which their officers, staff, solicitor, and other appliances would enable them to do, we have now a system in which the whole work is thrown on the country gentlemen, in which the Board is merely a kind of head inspector, and where half the moneys for the works must be contributed by the parties interested before the other moiety is advanced by the Treasury.

It is undoubtedly true that this Act was passed after much trouble and deliberation in both Houses. It took for its example the English Act, 24 & 25 Vict. cap. 133; but there is very little parallel in the drainage operations of the two countries. And, moreover, from habits of business, from the great wealth and resources of the country, they are enabled in England to secure that local co-operation and assistance which it is most difficult to obtain in Ireland.

Every previous amendment of the Drainage Laws was generally directed to expedite the preliminaries, and then to promote the execution

of the works by the advance of the money on such terms as were suited to the circumstances of the country. But the Act of 1863 imposes unnecessary delays, and will be found to be very little if at all adopted.

One of the greatest advantages likely to arise since the operation of the Act of 1842 was its enabling such measures to be accomplished without subjecting the parties to all the expenses of a separate Act, and the concomitants of separate establishments in each case. Now, in this respect the Act of 1863 is totally different. A second Act of Parliament has to be obtained, no doubt by the Board of Works; but still the delay in obtaining the second Act, and the delays in the preliminary proceedings, are sure to occupy from one and a half to two years, perhaps more.

The Drainage Acts of 1863 now come to be considered. The first is a short Act, 26 Vict. cap. 26, and merely deals with the power of private owners to procure outfalls for water-courses through the adjoining lands, at the expense of the party anxious to promote such drainage; but the second Act of the same session, 26 & 27 Vict. cap. 88, being an Act to enable landed proprietors to construct works for the Drainage and Improvement of Land in Ireland, is that to which we must draw your attention, as it is substantially the Arterial Drainage code for Ireland at present. It consists of eighty sections, and incorporates with it portions of several other Acts, including the Commissioners' Clauses and Lands Clauses Consolidation Acts.

The fourth section enables any persons interested in land liable to be flooded or injured by water, or the drainage of which may be improved, to constitute such land a drainage district; a petition is then to be presented to the Board of Works, accompanied by maps, schedules, and estimates, showing the works to be done, the names of the proprietors interested in the lands, and the probable expense; copies of these are to be lodged in the district for three weeks, notice thereof to be given to the Clerks of the Poor Law Unions and in a local newspaper, and also served on the proprietor; and all such parties are required, on or before a certain day, not sooner *than two months*, to transmit their objections to the memorialists. The Commissioners of Works are then empowered to send an inspector to inquire into the propriety of constituting the district; and he is, at the time and place of which notice has been given, to hear all parties, and report to the Board of Works, and his report is to be lodged with the Commissioners in Dublin, and with the Clerks of the Unions in which the lands are situate; and also maps, plans, sections, are to be deposited at the Custom House, and with the Clerk of the Peace for the county. It is clearly a mistake not to lodge the inspector's Report with the Clerk of the Peace, or the maps, plans, and estimates with the Clerks of the Unions; and this requires alteration. The inspector having made his Report, a month's notice of same being lodged is to be given to all parties to send in objections to the Commissioners; and if two-thirds of the proprietors *of the value of land* in the district concur in the report of the Inspector, the Commissioners may make a provisional order in writing, constituting the area a drainage district. Under the Act of 1842, the consent of two-thirds *in extent* of the

land required to be drained was required; but this frequently gave the owner of a bog more power to impede the works than the owners of land of the highest value; and the alteration of value for extent is a decided improvement. Notice of the provisional order is to be published in the Dublin Gazette, and copies served on such persons as the Commissioners may require. It then becomes the duty of the Commissioners to obtain the confirmation of such provisional order by Act of Parliament; and until that be obtained, the provisional order is of no effect whatever.

This is one of the most serious defects in the Act; the notices, survey, and preliminary labour, all take considerable time and in most cases the land must be seen in winter as well as summer, to enable the engineers to take the proper surveys, levels, &c.; but when all is solemnly and carefully done, the provisional order hangs on, a dead letter perhaps, until the ensuing session, when an Act of Parliament is obtained, which is merely an echo of the Provisional Order, and to which no opposition whatever is likely to be given. Under the Act of 1842, this serious delay was wholly unnecessary; the Provisional Order was fiated by the Commissioners after hearing all objections to it; and we see no reason why it should be different now.

Under the 8th clause, 6th section, the petitioners have to deposit the amount necessary to pay for the costs of inspection; but the preliminary expenses are chargeable on the district, should the works go on.

Sections twelve and thirteen deal with the constitution of Drainage Boards; and it is sufficient to say they are constituted local corporations, with a perpetual succession and corporate seal, for the drainage purposes of the districts. It would be tedious and uninteresting to go through the various sections of the Act; but we will now come to the thirty-third, which enables Drainage Boards to borrow money, for the purposes of the Act, at a rate not exceeding five per cent., on the security of the moneys accruing to the Drainage Board under or by virtue of the award to be made as thereinafter mentioned. By section thirty-four they may grant debentures, and the form is given. These may be transferred and paid off. By section thirty-six, the Commissioners of Public Works may advance moneys to the Drainage Board, to be applied for the completion of the works in the district; but the thirty-eighth section provides—"That no issue of such instalment or advance shall be made unless the Commissioners shall be satisfied that the Drainage Board have previously *bonâ fide* expended a sum of money equal to the amount of such issue or instalment in the drainage and improvement of such district, nor in any case shall such loan or advance be made exceeding one moiety of the moneys proposed to be expended on the drainage and improvement of such district; and every loan so given is to be issued in instalments not exceeding one-fifth of such moiety; and no second instalment is to be made until it be proved to the satisfaction of the Commissioners that the preceding instalment has been properly expended."

Now, on this security money will never be got for the works.

But we must hurry on with the sections of the Act. By the thirty-ninth, the Commissioners are to make an award, in much the same way

as under the Act of 1842; a draft of it is to be printed and published; notice of it to be given; objections to be heard; and the award then finally enrolled.

Under the forty-fifth section the Commissioners may make a special award for their own advances and protection; and the several lands in such award shall be chargeable with a rent-charge of £6 10*s.*, to be payable for twenty-two years. Under the forty-ninth section all moneys, including the rent-charges aforesaid, are charged on the whole of the denomination or townland, any part of which shall be drained or improved, or upon any portions thereof belonging to the same proprietor, which may by the award be made chargeable therewith. This is an improvement on the Act of 1842; for it gives a specific denomination for the security, instead of the collateral security of all the lands of the same proprietor within one mile of the lands drained. The rest of the Act requires no amendment, and deals only with general details and miscellaneous provisions.

Having now called attention to the principal sections of the Act of 1863, and to those amendments which can be suggested, we are at the same time bound to say that its general scope and tendency—namely, to throw on the proprietors the labour and requirements necessary to carry out the works, are not likely to be altered by Parliament, nor, indeed, is it beneficial they should.

Perhaps the principles upon which Parliament is likely to act cannot be better explained than by quoting the letters from the Chief Secretary for Ireland, and also the Under Secretary, touching the Suck Drainage District, one of the largest, most important, and pressing districts in Ireland.

The proprietors are very anxious to have the Drainage works commenced, and anxious that the Government should undertake to bring in a special Bill for that end. At the last Ballinasloe fair a meeting was held; Lord Clancarty was in the chair; Mr. Holmes, the Secretary, read the following letters from Sir Robert Peel, M. P., and from Sir Thomas Larcom:—

"*Dublin Castle*, 15*th December*, 1863.

"Sir,—I have to acknowledge the receipt of your letter of the 8th instant, with its accompanying copy of resolutions passed; at the meeting of the proprietors of estates adjoining the River Suck, and I beg to acquaint you that, before giving the deputation the trouble of coming to town, I shall be glad to be favoured with a more detailed statement of the provisions of the Bill they wish the Government to introduce, to guide me in determining how far the Government could pledge themselves to entertain the proposal at all.

"I would venture to point out to the Committee that any scheme to improve the drainage of the River Suck, in connexion with the Shannon, must materially depend upon the improvement of the latter; and it is to be feared that the proprietors of lands adjoining the Shannon will object to any additional outfall at Shannon-bridge, until the improvements recommended by Mr. Bateman are carried out.

"There appears to be a further proposal for diverting the waters of the Suck from about one-third of its total rain basin by a cut from Athleague to Loughree; but Mr. Bateman reports that the expense of the work seems likely to exceed the benefit, and that

Loughree cannot bear any material addition to its waters. Under these circumstances I hope the Committee will concur with me in opinion that it would be desirable I should be favoured with more precise information before putting them to the inconvenience of a personal interview.

"I am, Sir, your obedient servant,

"ROBERT PEEL.

"*J. A. Holmes, Esq.*"

"*Dublin Castle, 15th April*, 1864.

"SIR,—Referring to your letter of the 7th instant, I am directed by the Lords Justices to acquaint you, for the information of the gentlemen who comprised the deputation to Government respecting the drainage of certain lands liable to be flooded by the River Suck, that the subject having been brought under the consideration of the Lords Commissioners of Her Majesty's Treasury, their Lordships observe that they understand that the object of the deputation in question was to induce Her Majesty's Government to sanction the execution of the works required for the purpose through the instrumentality of the Board of Public Works in Ireland, and that it will no doubt be recollected that in former periods, previous to the year 1853, several very extensive works of arterial or river drainage were executed by the Commissioners of Public Works, none of them, however, approaching either in area or cost the magnitude of the works which form the subject matter of the present application.

"Their Lordships believe that the estimates for these works were prepared with the utmost care by the Board of Works; nevertheless, as the works proceeded, it was found that in almost every case, from causes which probably could not have been foreseen, the amount necessary to complete the works would be at least double that of the original estimate.

"The landowners on whose behalf the works were undertaken by the Board of Works became not unnaturally dissatisfied at the prospect of being subjected to a charge for the repayment of the cost of the works much greater than they originally anticipated. Appeals were made to Her Majesty's Government and to Parliament—a Commission of Inquiry was appointed, and the result was a loss to the public, on eleven drainages, of more than £100,000.

"Their Lordships are aware that this loss may be in part attributed to the disastrous state of things in Ireland, when many of these works were in course of execution; but they request attention to the following general remarks, made by the Commissioners of Inquiry—Sir R. Griffith, Sir W. Cubitt, and Mr. Rendal—into the drainages of the eleven districts referred to, while endeavouring to justify the remission of no less than £106,000, on the very grounds of the disasters of the period:—

"'We must not,' they state, 'be understood by this recommendation to imply our approval of a system which imposes upon a public board the duty of designing and executing works of this character, or which invests such a board with the irresponsibility which, sooner or later, must bring the Government into collision with the governed.

"'Such a system is objectionable from its tendency to induce the community to look to the Government for guidance in their local affairs and ordinary social duties.

"'Hence arises a dependence which checks that progress which results from self-reliance and experience in the management of their own affairs, and which is wholly contrary to the spirit of our government.'

"The impolicy of the system of thus extending the duties of the Government cannot, in our opinion, be better put than in the words of Sir Charles Trevelyan, in his evidence given before the Select Committee on the Miscellaneous Estimates in 1848, when he says, in answer to a question put to him by a member of the committee:—

"'I conceive that it places the Government in a most false and injurious position towards the whole body of the people. It places it in the relation of creditor to debtor to every landed proprietor and farmer all over the country; and it continually poisons and irritates the public mind, by the necessity which the Government is under of recovering the public advances.

"'I conceive, also, that it nourishes and perpetuates the habit of depending upon others, which prevails to so great an extent in Ireland; and I am of opinion that nothing

could be done which would have so great a tendency to consolidate the empire, and to give a new spring to the energies of Ireland, as to cease to grant any public assistance of this sort whatever.'

"The cogency of these remarks appears to their Lordships to apply peculiarly to the case of works the execution of which is undertaken at the solicitation and for the advantage of private parties by the Board of Pnblic Works, whose functions, in their Lordships' opinion, should be limited, as far as possible, to works which appertain to the public.

"Their Lordships state that they need not advert to the increased staff at the Board of Public Works, and the consequent cost to the public which the execution of such works as those proposed would entail; and that they are not aware how far the provisions of the Act passed last session, 26 & 27 Vict., cap. 88, for the Drainage and Improvement of Lands in Ireland, would be applicable to so large a work as that connected with the River Suck, comprising an area of 72,000 acres; but that Act appears to them to contain the only principles which can be safely adopted with reference to such works—namely, that while the Commissioners of Public Works are to afford the information, advice, and assistance which their experience may enable them to supply as regards the preliminaries of such works, the responsibility and control of the parties interested should be clearly maintained as regards their execution.

"With these views, their Lordships regret that they cannot sanction any proposition which would impose upon the Board of Works the charge of executing such works as those proposed; but they will be prepared to consider any measure which may be submitted, founded on the principle of last session, which may facilitate the execution of such works at the cost and under the responsibility of the parties interested.

"I am, Sir, your obedient servant,

"THOS. LAROOM.

"*J. H. Holmes, Esq., Abbeyville, Roscommon.*"

These reflections are admirable—the principles good; but in order to encourage the local proprietors, greater assistance in the advance of the money for the works should be given. The security is undoubted, and of a first class character for the Commissioners of Works and the Treasury. No such complaints against repayments of advances can ever arise again as occasioned so much trouble before. It may be said here, can that be good security for the Treasury, upon which a private lender will not advance his money? The answer is plain, the Treasury can always secure themselves by special legislation, and no private lender will take his money back bit by bit; whereas the staff of the Board of Works at present organized in receiving the advances made in Ireland, can do so without any serious additional trouble or expense; moreover, under the Act of 1863, the advances by the Board of Works take precedence of the loans advanced by a private lender. Thus the operation of the Act is this:—That two-thirds of the proprietors may have to carry the project on, and to find a moiety of the money required—in other words, to find the money in the first instance for themselves and the unassenting or dissenting one-third proprietors of the district; and then, under certain circumstances, the other moiety lent by the Board of Works takes precedence of the loans advanced by private lenders.

Practically, in my mind, this is a complete impediment to the general adoption of the Act; and in the Athboy district, money has been refused to be lent on such security on the advice of an eminent lawyer.

It may do in small districts, where one proprietor is concerned; but in large districts it is a total barrier, or, if not, will force the Drainage Trustees to borrow money, as in certain railway projects, at a very high rate of interest, or in ruinous contracts; moreover, it is wholly opposed to the kindred Drainage Act for Landed Improvement. There all the money is advanced repayable at six and a half per cent. in twenty-two years, and the advance is made for the private benefit of the parties concerned; but, as far as the public and the legislature are concerned, the arterial is far more a public and national question than the thorough drainage, and requires more co-operation, and is open to all the disabilities of proprietors, and difficulties set out in the preamble to Mr. More O'Ferrall's Act. It is to be hoped, therefore, the Treasury will not oppose a measure altering the present Act, in providing the whole of the moneys repayable in twenty-two years, where the Board of Public Works are satisfied of the usefulness of the works, of the proper expenditure of the money, of the undoubted nature of the security, and that the works would not only pay for themselves, but also afford employment, and improve the soil of Ireland.

The system of Private debentures failed in 1831, under More O'Ferrall's Act.

Substantially it failed in 1842, and up to 1857, under the Drainage Acts; and it has failed since the enactment of the Act of 1863. But when you see by the last return of the Board of Works, that out of £902,148 13*s*. 6*d*., expended on arterial drainage, £688,837 17*s*. 4*d*., or two-thirds, has been repaid (in most cases since 1852), then, I say, the Treasury has no reason to doubt that all moneys advanced will be also repaid. Stronger still is evidence of the repayment under the system of land prepayment for Thorough Drainage. In that case the total loan authorized was £2,000,000. The advances up to the present date amounted to £1,780,000, while the total amount of the repayment is £1,450,000 sterling.

The number of districts for which memorials have been presented since 1863 is ten:—Athboy; Ballinacarrig; Thurles (abandoned); Rathdowney; Sixmile Bridge; Kilmastulla; Silver River; Parsonstown; Carnogue; and Elphin. But of these, not one that I know of will be carried to completion unless the Act be amended.

There is no reason whatever for the Parliamentary powers to confirm the order of the Commissioners of Public Works to constitute the district; the clause was introduced in the House of Lords from the impression that the powers to be exercised by a drainage board were analogous to those exercised by a railway company, or such like, where land is taken from the owners on which to construct works; whereas, in drainage, the large channels existing are generally deepened and widened, the smaller channels alone are altered by shorter cuts, and "give and take" lines, occupying less space than the old courses, and all by the owners associated for their own benefit, and not, as in the case of railway company speculators, who for their own purposes take land away from the owners.

Under our peculiar circumstances in Ireland, some encouragement and assistance from the Government is necessary to enable us to make these improvements, the security for the loan is unequivocal; and the Treasury might surely be content to lend us money at a profit, getting four per cent., while they borrow at a lesser rate.

Further, the Act might be fairly amended by rendering the consent of one half the proprietors, or a simple majority, enough to bind the others, and constitute, with the approval of the Board of Works, the district for drainage purposes. The principle is admitted in sect. 31 of the 24th & 25th Vict. cap. 133, known as "The English Drainage Act."

In fine, the chief complaints made in relation to the Drainage Acts for Ireland are as to the tedious nature of the proceedings; and to the means provided for raising money to carry out the projects.

No doubt, the preliminary proceedings are the same as those followed in the English Drainage Act of 1861 (24 & 25 Vict. cap. 133), carried out under the Enclosure Commissioners; and also the Harbour Act of the same year (24 & 25 Vict. cap. 44), worked out by the Board of Trade. These two Acts appear to have furnished the model for the Irish Act; and all are based on the system of "Provisional Orders" issued by these departments, to be afterwards legalized by Act of Parliament.

But upon a proper representation, Parliament would, we feel assured, alter these provisions, which stand in the way of improvement so much wanted, and so completely shown to be highly beneficial to the country at large.

The Drainage Laws are a complete contrast to the Railway Laws. These, since 1846, have been simplified, rendered cheap, time shortened, and all arrrangements for obtaining lands expedited. Why should it be said that the Drainage Laws cannot be likewise improved? The object of this paper has been to show that the Laws relating to Arterial Drainage are not so difficult to comprehend as most country gentlemen or their land agents imagine, and that there is still much to be done in Ireland by the owners and occupiers of land, by the Board of Works, and by Parliament.

It is the duty of all who are interested in the prosperity of Ireland to see that the career of improvement is not stopped; to explain that, even at the present rate of wages, drainage works will pay; and to seek from the House of Commons a more liberal application of the public money, based on such undoubted security; and to ask for an amendment of the present Act in the instances specified.

Undoubtedly, claims such as those put forward are looked on with great jealousy in England. Why should Parliament help local proprietors to drain their lands, if they will not contribute half the moneys themselves, or do anything to forward their own interests, and show the regard in which they hold the improvement of their estates? This is a question which must be met and answered. Now, most proprietors whose estates are settled will never be able to obtain their share of the

moneys under the present Act: even if they did, the money market may range from eight to eleven per cent., while they must not borrow at a greater amount than five per cent. under the 33rd section. It is surely as strong a case for help as the loans under the Thorough Drainage Act; and as there are no more navigations to be opened, the works to be done not consisting of bogs or waste lands, would be both moderate and practicable. The Board of Works has, under the presidency of a most useful public officer, Sir Richard Griffith, its late chairman, done good service to the State, but its younger members ought to be anxious for a larger sphere of usefulness. They have been in past times attacked and misrepresented; but that is the fate of all men who do their duty. For instance, the piers on the Lower Shannon are a constant cause of complaint against the Board of Works: at Kilteery, at Cahercon, at Glin, and indeed at other places, piers have been erected at which no sail, even of a turf-boat, is ever seen. The passengers at Cahercon still land from, and take the steamer in an open boat. At Red Gap, the finest site on the Shannon for a pier, no pier has been made; and why? because the Shannon Commissioners acted on the principle that they would only help those who advanced part of the moneys required. For the piers at Kilteery, Cahercon, this was done; but the piers are useless, and only gratified the local proprietors' caprice; better, far better, to have not built them at all, than to have placed them, no matter what local aid was given, where they are of no public use. I refer to this to show that local aid is not always a sure indication of the undertaking being publicly useful, and that the Board of Works are not responsible for the want of piers on the Lower Shannon. If the Drainage Act be amended, a clause relating to the erection of piers ought to be inserted in it.

I have to thank the Society for the patient hearing which they have given my paper. For my own part, I have endeavoured to bring the matter forward with a single view to the improvement of the country and employment of the people. For the sake of the Royal Dublin Society, I could have wished it were more complete; but I thought no place could be more appropriate than here to discuss a subject so deeply interwoven with that for which the Society was founded over a century and a quarter ago, namely, the improvement of Irish agriculture. The Society has seen many vicissitudes since then, but it has outlived them all, and, I hope will long continue a career of usefulness and energy in those departments to which it is specially dedicated. I deem it a happy augury that this paper, however imperfect and unworthy the Society, should be the first read after the noble Lord, Her Majesty's representative in this country, has accepted the office of President. I have no doubt that in any reasonable and well-considered project to improve the material condition of Ireland, he will be found to give the aid of his commanding position and undoubted ability to further it. The Right Hon. Gentleman, the Chief Secretary, who bears a historic name, has already shown, in the case of the loan for the Dublin Waterworks, his anxiety to serve that most necessary undertaking; and with their aid (if ob-

tained), with a rational and well-considered statement of the case, it is to be hoped that the Chancellor of the Exchequer, who is as matchless in finance, as he is unrivalled in eloquence, will assist to amend these Drainage Acts, and thus confer a lasting benefit on Ireland, in the development of its resources, and the employment of its people, without any loss to the empire.

MR. JAMES HAUGHTON congratulated Mr. Joynt on the ability with which he had brought the subject forward. It lay at the root of their agricultural prosperity. Irish proprietors had free trade; and therefore it was their interest that the soil should be made as productive as possible.

MR. NATHANIEL HONE DYAS said that as Hon. Secretary of the only Drainage District, the Athboy, county of Meath, which had yet been constituted under the Act of 1863, he ventured to make a few remarks. He generally concurred with Mr. Joynt, but differed from him in one or two matters. Thus Mr. Joynt said it would take from one to two years to form a district. Now, in the Athboy district it occupied less than nine months from the first preliminary meeting, at which the proprietors decided to proceed under the Act, and to employ engineers to make the necessary plans, till the Drainage Board held their first meeting under their Act; but as the District was a small one, and the engineers, Messrs. Gray and Brazill, completed their work with great expedition, and owing to accidental circumstances the Act passed through its stages very quickly, one year might be said to be the time necessary under the present law. The procedure was very complicated, and might be much simplified in its details; and also the time shortened: for instance, one month instead of two would be quite sufficient time to allow for objections to the preliminary plans and estimates. Then there was no occasion for an act of confirmation, which caused considerable delay. The Act for the Athboy District seemed to be copied from the Acts confirming the Provisional orders made under the English "Local Government Act," in which case an Act was very proper, as possession would be taken compulsorily of lands and houses; but under the Drainage Act the only property that would be compulsorily affected in an injurious manner would be mills; but it was expressly enacted that the Commissioners should not sanction any such injury, unless they should be satisfied it was of such a nature as to admit of being fully compensated for by money. It therefore became a mere matter of £ *s. d.*, to be decided by an arbitrator, as directed by the Act, and consequently there was no occasion for a special Act. It would afford sufficient protection to property, in fact more than at present, if, instead of merely lodging the inspector's report at the Union Workhouse, a notice were served on each proprietor, millowner, &c., requiring them, if they had any objections to the report, to appear before the Commissioners on a day named in notice; and the Commissioners should be authorized, after such day, if they thought fit, to issue an *absolute* order constituting the district. The main difficulty, however, was as to the money clauses; they were very complicated and obscure, and should be amended before the Act could work easily; but nevertheless Mr. Joynt had overrated their defects; for, although it was quite true a lender would have no absolute security till the award was made, still in practice this should cause no difficulty, as the Commissioners were required to make the award on the completion of the works, or, if they thought fit, on the expiration of the time allowed for their completion; and if possibly there should be any delay or default in the execution of the works, any lender had power to apply to the Commissioners, and ultimately to the Court of Chancery, to enforce it, and thus procure the award. The land in the district should be made provisionally liable previous to the award. It was not, however, any diffi-

culty as to the award which prevented the Athboy Board from obtaining money previously; it was the state of the money market, and not being authorized to pay more than 5 per cent.; the maximum interest should be increased to 6 per cent., as 5 per cent. was not sufficient in these days of limited joint-stock companies, though it probably was when the 5 & 6 Vict. was passed, as apparently it was from that Act that the precedent was taken. The priority of security over the debenture holders given to the Board of Works, in respect of money advanced by them, was not fair. The Board of Works should get a discretionary power to lend more more than half the sum required for the works, without requiring any previous expenditure.

THE RIGHT HON. SIR ROBERT PEEL, Bart., said—Mr. Chairman and Gentlemen, I came here to-night only to listen, and to study a question of great and vital importance to this country; but having been so pointedly alluded to by the hon. gentleman in the observations which he has addressed to us, I cannot refrain, and I hope you will not consider it as presumption on my part that I should offer a few remarks. In the first place, I think I do but express the general feeling of the gentlemen present in saying that Mr. Joynt has evidently given this subject a great deal of study; and that he has laid before us his views in a very clear and lucid manner. I feel he is entitled to our thanks for treating the subject in the manner he has done. He says his only object—and we all who are here to-night admit it—is to endeavour to elucidate the opinions of persons interested in the welfare of this country, and draw them to some practical conclusion. Now, I think the observation which fell from the hon. gentleman who first spoke upon the question, hits the right nail on the head—that this question of the drainage of Ireland is, as he said, at the root of the agricultural interests of this country. It is a very great and important question to Ireland—one that has a direct and important practical bearing not only upon the state of the occupying tenantry of this country, not only upon the labouring classes, but upon, as he justly observed, the landlords of the country. It is a question which, in the interests of the landlords themselves, they should endeavour, if possible, to elucidate public opinion upon. I have been, I am happy to say, a good deal through different parts of Ireland; and what is it that strikes an observing traveller or visitor to any particular district? It is the great trials to which the farmer is subjected from the vast amount of undrained land which prevails. We have to contend in this country, not only with a very humid climate, but with vast districts which might, I venture to say, be perfectly well drained, but which unhappily have remained to the present day chilled and blighted by the stagnant waters which for a long period of years cover them. Well, I say, that being the case, any of us who desire in this agricultural country to see the connexion between the landlords and tenantry of Ireland, the occupying tenantry, and others, strengthened, will readily concur, that that which will improve those relations upon a sound basis, well merits the best attention of this most distinguished and patriotic Society. Now, I should have been very glad to reply with greater precision to the observations of the hon. gentleman, but I have not the advantage of the desk and manuscripts which he had before him. His observations, moreover, were rather too rapidly delivered, and we on this side of the house had some difficulty in following him. Much that he said, however, was good. In going through the history of what had been done in the way of drainage in this country, he gave valuable information; but it struck me that he endeavoured to show that the Board of Works was unpopular with the gentry of this country. I do not admit that. I do not think there is any board in this country which has done more service for Ireland than the Board which had at its head for so many years that most distinguished civil engineer, Sir Richard Griffith. I admit there have been grumblings. It could not be otherwise in a question of this kind. Such a question as that which he has brought before us involves a very difficult task to the Government to deal with. It requires a vast deal of consideration. The hon. gentleman, I think, said that certain proprietors, having property in the neighbourhood of the Suck, wanted the Government to do their work. That was not the case. Certain proprietors along the Suck came to me last year, and said:—"We are prepared to advance to the utmost of our ability; but what we ask, is," as they said very fairly, "that we should receive that just assistance from the Government which would enable us to carry out works which would really

be of great national importance." Well, now, that is the real point. The hon. gentleman told us that the drainage of the Suck, irrespective of the works on the Shannon, would cost about a quarter of a million sterling. He over-estimated the amount, I believe. I speak from memory. He has spoken from a paper, and therefore has an immense advantage over me; but I believe that £180,000 would amply suffice for that particular work. But how is it possible that these proprietors can lay down some £70,000, before they can get the advantage of commencing work of this magnitude? It is impossible I could agree with the hon. gentleman in the sentiment I fancy to have caught from him in this respect. On the contrary, I hope the Government—the Imperial Government—will give that assistance which such cases require; and of this I feel certain, that that Imperial Government will be entitled to the best thanks of the community in Ireland—that Government will be esteemed in this country as one of the most beneficent—it will be that one, at all events, whether in office or out of office, to which I shall give my support, if it will deal boldly with this question—if it will not hesitate to grant money for work which, I am firmly convinced, will have the indisputable effect of raising a very great and important class of Irish people from a depression under which they labour, and of making them an intelligent and self-relying agricultural class. Well, now, the honourable gentleman quoted a noble lord (Lord Lifford) in another place. We have nothing to do with that House here, but in our place we are ready to meet any objection that may be placed before us. I cannot follow exactly the remark made by a noble lord in another place; but an honourable gentleman (who made some observations to-night) said the great thing was to give employment to the country in those great national works. I agree with him. We have had an immense emigration going on for the last few years. I think that since the year 1861 nearly a quarter of a million of people have left the shores of Ireland, perhaps never to return. I have heard people say that this emigration is the safety-valve of Ireland. Well, now, although it may be perfectly true that nearly a quarter of a million of persons have left since April, 1861, such has been the excess of births over deaths, that really that number is considerably diminished; and the total number up to the present time, as I learn, does not exceed 130,000 persons who have left this country. But it is an important item with respect to the civilization of Ireland. However, I do not admit, myself, that emigration ought to be considered as the safety-valve of Ireland. What we want to see is that steady, that remunerative employment of the agricultural labourers which will do away with all this talk about emigration being considered as a safety-valve for Ireland; and how can we best set about it but by undertaking works such as the honourable gentleman has pointed out? We have all of us, I venture to say, very many at least in this room who take an interest in the question of drainage, read the various reports which have been made on the subject since 1811 to the present time. These Reports are full of information. We find—I believe I am not overstating the mark, when I say that I think there are nearly at this moment 4,600,000 acres of land waste, or bog, and uncultivated. That is an enormous mass in an area of about 20,000,000 acres—very nearly a quarter of the whole area of the country. It would, I think, take eight or ten million of pounds sterling, spread over a series of years, to drain that. We don't ask that. The gentlemen do not go so far as that, and very wisely. I will tell you what I would like to see, and I believe there is in this country adequate security for such a work, and in this work I should like to see three-quarters of a million sterling well laid out in drainage works—not for the purposes of arterial drainage, but for thorough drainage. With that sum of money you might drain 150,000 acres of arable land which very much require it, at the cost, at the very highest, of £5 an acre; and I venture to say that there is not an agriculturist in this room who will not admit that the application of that money would render the letting value of the land at least 10 per cent. higher, at a fair valuation, than it was before that operation. Well, is not that in itself a sufficient guarantee for the security that would be forthcoming from an action of that kind? Unfortunately, in this country, there are so many small occupiers, that there is an immense competition for land of any kind; and in the county of Cork and elsewhere, I have seen land which I have been told was set at from 18*s.* to 22*s.* an acre, but which was so cold, and chill, and rank from the water standing upon it, and from the want of drainage, that I venture to say that it was not worth 5*s.* an acre. I ask you, as reasonable men, how can the te-

nant be expected to pay his rent under those circumstances? It is impossible. And then comes that much more difficult question—from the uncertainty of tenure under which some are placed, the tenant is naturally unwilling, were he able, to undertake improvements which might entail only heavier rents without due consideration of his own outlay. Now, a great difficulty that we have to struggle against in this country is undoubtedly—I do not think there is a man in this room that will contradict me—that we are encumbered in our operations for drainage purposes on a large scale by an enormous number of small holders. Will any one credit that in this country, out of 600,000 holders of land, at least, 450,000 of them are holders of less than thirty acres, and a vast proportion of these under five acres? That is a state of things which all of us, in the best interests of the country, in the best interests of the people who hold that land, wish to deprecate. It would be infinitely better for these small holders of half an acre, or two acres, or five acres, to become intelligent labourers, rather than to be wasting their time and their substance—substance they have none—but to be wasting their time upon those small holdings from which they never can acquire a position, and which certainly are one of the black spots, I think, in the agricultural interests of the country. Well, now, the honourable gentleman said that he did not despond, however. He said—I think I quote his observation correctly—that he did not despair of the country. Although much has been done, and although much is required to be done, yet still I am happy to say there is a vast improvement in agriculture going on in the country, which only wants a little stimulus to vibrate through its whole extent. I cannot bear—going through this country as a common traveller—I cannot bear to hear it eternally dinned into my ears that the country is going to ruin and decay. I see nothing of the kind. I see improvements of every kind that represent the prosperity of a country—railways, savings' banks, and so forth; and I must say, for one, that I see no reason to despond. I see prospects of a brighter future dawning before us. But I cannot bear to see, by men who know nothing of the matter, a grievance chalked up upon every milestone along the road, just as if it was put there in order to tell the travellers and visitors—and they come here in vast numbers during the season—that, whilst they admire the beauties of our scenery, and observe the resources of our country, they are by no means whatever to contribute their capital for the development of those resources. Well, I say, that is a bad way of setting about our business. Let us put a good face on the matter. I have been four years in the country, and I have had some opportunity of observing them, and I say that the people of this country are a most intelligent—ay, and a self-relying people; and I believe that what we require is, not to be told constantly that we have grievances to complain of, but boldly to put shoulder to shoulder, and that one class should support another; and then we should see that the resources of the country and the intellectual capacities of Irishmen are not surpassed by those of any other people in the world. I must apologize to this company for having detained them so long; but there is one remark which I should like to make before I sit down. We have a strong body in Parliament. Every county, as the hon. gentleman has said, has its representative to advocate its interests. What I should like to see would be a measure pressed upon the Government—pressed upon the Imperial Government and upon Parliament by that legitimate Parliamentary influence, that fair and honourable co-operation and pressure, which would result in the carrying of some such measure which would have the effect, in my mind, of greatly relieving the agricultural interests by the fair and just granting of public money for the purpose of draining in this country. I maintain that this is a great imperial question. The hon. gentleman has alluded to the works on the Shannon. The navigation works there completed were considered an imperial question, and this country is greatly indebted to the exertions of Lord Monteagle, when he was Chancellor of the Exchequer, in furthering and pressing forward a measure of that kind. I look upon the drainage of those vast tracts in Ireland as a question that ought to be dealt with by the Imperial Legislature. Individual proprietors cannot grapple with it—every one admits that. Look at what the Imperial Legislature spent upon the Caledonian Canal in Scotland. Look at what the Imperial Parliament spent upon the Rideau Canal and Ottawa River Navigation Works in Canada—over a million sterling for 128 miles. And then look at our magnificent Shannon, spreading over two hundred miles of this country, running through ten counties, and

having a population within reach of its influence of over a million of people. Does not that represent something worthy of the support of the Imperial Parliament? It is true that they gave us, I think the honourable gentleman said, £580,000, to do certain navigation works, and that those works were done. They were well done, I believe. But they have been pernicious to the drainage principle. Why do not the Government come forward now, and treat an imperial question like this as it ought to be treated? Sir Richard Griffith, whose name it is only necessary to mention, has told us that there is no bog land in Ireland that cannot be drained. Sir Richard Griffith tells us that you may drain, I will not say the very worst, but some of the worst land in Ireland, for, I think, £7, or certainly £7 10*s*. an acre, and that in two years afterwards that land would be worth thirty shillings an acre for a crop of rye, and then a crop of oats, and then a crop of potatoes. There is always manure, observe—and this is an important point—at hand, suitable for the purpose of improving those bogs. I see a gentleman here who is practically acquainted with these matters; but I believe that under these bogs there always is a stratum of clay, which, mixed with turf ashes, is admirable for the purpose of applying to the decomposition of the peat. Therefore, considering that we have in this country about 4,500,000 acres of land in the condition which has been referred to—and considering that in the opinion of Sir Richard Griffith it could be brought into a valuable condition, I do think that this question is well worthy of the attention of the public. I, for one, congratulate the honourable gentleman, as a public man, for handling this subject in the able and lucid manner in which he has treated it. I thank him, because I believe that he has dealt with a subject which is of the utmost importance to this country; and I am quite sure that, if it is treated in a liberal and generous spirit, it will contribute more than anything else to build up a more cordial understanding between those classes which represent in a very large majority the chief industry and the best interests of Ireland.

Mr. W. F. Vesey Fitzgerald, said, that the Right Hon. Baronet (Sir R. Peel) was correct in attaching quite as much importance to thorough drainage as to arterial drainage; that it was more profitable, and more certain to succeed; that he had experience of both, having had a good deal to do with drainage, in the management of his property in different parts of Ireland.

After a few observations from Mr. James Ganly, in commendation of Sir R. Peel's views,

The Chairman (Mr. G. W. Maunsell) congratulated the Society upon the manner in which the important subject of the evening had been brought before them, and upon the very able speech it had elicited from the Right Hon. Baronet, the Chief Secretary for Ireland. It was cheering to find the Right Hon. Gentleman among them, taking active part in their proceedings, and studying for himself, and it might be hoped for amended legislation, the bearings and the difficulties of a question in which the welfare of Ireland was so deeply involved. It was the more gratifying when they recollected that it was under the Premiership of the late illustrious Sir Robert Peel that the drainage code was first matured; and the liberality of Parliament, by sanctioning advances of public money for such works, gave the first great impetus to the many and substantial benefits that had since resulted to Irish agriculture. The new Act, so ably commented upon by Mr. Joynt, was the inauguration of a new era in drainage operations; and it behoved all parties to strive earnestly to make it as effective as possible. He regretted to agree with Mr. Joynt that he saw in the Act, as it now stood, difficulties which, except in very favoured districts, threatened to render it almost inoperative. By the former code, the execution of arterial drainage was intrusted to the Board of Works. He would not detain them by going over the details of a system with which most of them were familiar; but he must bear testimony to the very able manner in which the Board had discharged their duties. It was not in human nature they should have pleased every body. But they had been the pioneers of national

effort in this direction; they had taught how conflicting interests could be adjusted for the common good, how public advances could be made with perfect security for repayment. And he confessed that, when he reflected upon the prodigious amount of arterial drainage done under the auspices of that Board, as detailed by Mr. Joynt, he looked with considerable apprehension to handing over to the landowners the discharge of such duties, which, with some aid, no doubt, to be still had from the Board of Works, was the principle of the new code. Before coming to the objections to the new Act, which had been so ably treated by Mr. Joynt, he would ask leave to refer to an Act which might be said to form a part of the new Drainage Code, and which had been passed almost without remark by him. He meant what might be called the Outfall Act of 1863—the 26th Vict. c. 26. This Act might be said to be the work of Mr. Francis Longworth Dames, one of the ablest men at the Irish Bar, who had in the previous session, 1862, by framing the Bill known as Col. Dickson's Bill, and which he had successfully carried through the House of Commons, in fact laid the foundation of the present Act, 26 & 27 Vict. c. 88. By the Outfall Act, which is both short and simple, power is given by a very summary and easy proceeding, viz., application to two magistrates in petty sessions, to compel the owners of the lower levels to permit all watercourses to be cleared and deepened which obstruct the discharge of waters from the upper levels; such a power is both equally novel and valuable; it may not often occur that the owners of lower levels are so churlish as to prevent such improvements at the cost of those who desire to make them; still, it is well the power should be known; and the restrictions in the Act are ample to prevent its being made an engine of injustice or hardship. He would not touch upon those amendments required in the simplification and shortening of proceedings under the principle of 1863 Act, c. 68, which had been so fully handled by Mr. Joynt, Mr. Dyas, and other speakers; but he would come at once to the financial difficulties, and he thought both the meeting and the landowners of Ireland should feel grateful to the Right Hon. Baronet for the liberal spirit with which he had dealt with this part of the case, and had frankly stated his opinion, that both the duty and wisdom of governments lay in liberally aiding such works by advances made upon terms which, while sufficient to secure the public from loss, would encourage and stimulate the execution of improvements which could not otherwise be effected, and realize for the community at large the substantial advantages such improvements cannot fail to produce. The first principle of the new code was, that the landowners were to provide by private loan the first moiety of the funds required; the Board of Works being then empowered to lend the other moiety, to be advanced *pari passu*, they obtaining a first charge upon the lands benefited. It might be possible in small and highly favoured districts, where, as Athboy, the owners were such men as Lord Darnley, Mr. Chapman, Mr. Rotheram, or Mr. Dyas, to obtain the first moiety—men of great wealth and iron determination might do so, but in nineteen cases out of twenty it must fail. The first question would be, at what period can a perfectly valid security to a private lender be given? It is the award which gives validity to the security; but the award cannot be made till the works are completed, and the money expended; and meanwhile the lender must rely upon the preliminary arrangements. Questions may arise how far the plan upon which first assents have been given has been in fact carried out; and the award may in the end become the subject of fierce dispute—a pleasant position for private lenders. No doubt the holder of a debenture may, upon default of the owners, call upon the Board of Works to make an award; but what all private lenders desire is a security which from the moment they advance their money they may put away in their strong box, without further acts to be done, or looked to, certain in its validity, easily transferrible, and not open to be paid off by vexatious instalments. Such statutable securities have always found but small favour in Ireland, and but few lenders. The solicitors did not understand them. No solicitor could be expected to advise clients to lend money upon securities beset

by long preliminary conditions—perhaps conflicting opinions, doubtful construction of clauses, decisions by boards or commissioners, when investments free from risk and trouble based upon the general law of the land were competing around. These were views which he had no doubt would be pressed by the Right Hon. Baronet in the proper quarter, and which coming from him would be entitled to every consideration. He (the Chairman) had, in conclusion, again to congratulate the Society on the importance of the discussion. The promotion of husbandry was especially one of their chartered duties. How they had heretofore fulfilled their obligation in that respect was but too well known. In no direction could their labours be more usefully given than in studying the difficulties which beset the great question of Arterial Drainage, and consulting how the new system could be made most effective and most extensively useful. He looked forward with hope to results equally important and valuable arising from their meeting this evening; and trusted their successive meetings for the present session would be equally interesting, instructive, and advantageous.

Mr Lane Joynt then said, in reply—Sir, I have to thank the Society; I have to thank you, Sir; and, above all, I have to thank the Right Hon. Gentleman the Chief Secretary for Ireland, for the friendly interest, and still more friendly criticism, with which my paper has been received. With that reception I am well content; but I know it is owing to no treatment of mine. It is due to this, that the subject is one of great national interest and urgency—that it opens a prospect for employing the people, improving the soil, and enriching the landlords and tenants of Ireland. I feel quite satisfied that the eloquent and outspoken words of the Right Hon. Gentleman will reverberate throughout the length and breadth of the country; and I am much mistaken if the public voice will not unanimously sanction a policy which is as bold as it is wise, as worthy of the most generous feelings as it is creditable to the highest statesmanship. There are two points in the observations of those who followed me, to which I shall refer. The first is that made by the chairman touching the Outfall Act of 1863. Those present will remember that I only briefly referred to it, and for this best of all reasons, it requires no amendment. I deal to-night with suggestions for the amendment of the Drainage Laws, and therefore it would have been out of place to refer at any length to an Act which requires no amendment. Moreover, I had but scant measure of time for what I had to say, and I was equally desirous to exhaust the subject without exhausting the patience of my hearers. The second point is, however, the most important of all. If Mr. Hone Dyas's observations be well grounded—if I have, in his own words, overrated the defects of the Act in regard of the time it will take to form, work, and legalize the arterial drainage of districts in Ireland, and if I have, above all, overrated the defects of the Act of 1863 as to the borrowing powers, then my whole case fails. I know, Sir, a bridge is not stronger than its weakest part. Now, these are the two weak points of the Act of 1863—delay and want of funds; and unless before I sit down I can dissipate the fallacies put forward by Mr. Hone Dyas, I have no right to suppose that you will conceive the Act is useless, and the difficulty of getting funds for the works insurmountable. Let me do so as briefly as possible. In the first place, then, let me notice that Mr. Hone Dyas represents a very small district—that of Athboy, with only seven or eight proprietors, all wealthy, anxious for improvement, and who have confided the working of the district to him. I am sure their confidence in him is well founded. But the smallness of the district with which he is connected has made him underrate the extent, the preliminary proceedings, the delays, and difficulties in the path of those who undertake works, not like Athboy, whose estimated cost is only from £8000 to £10,000, but whose estimated cost, as in the Barrow and the Suck districts, varies from £160,000 to a quarter of a million sterling. Surely if such works, under the present system, can be commenced; if the surveys, in the height of winter and autumn floods, can be made—if the meetings and notices are duly held and given—if then a second Act of Parliament has to be obtained, it is not too much to

say, nay, it is within the mark to say, that the districts generally under the present Act will take from one to two years, perhaps more. We know from experience that one or two years in the life of a great drainage work is but a short term indeed. But Mr. Hone Dyas's second point astonished me more than the first. He said I overrated the difficulty of getting the money for the works. I own I heard that with astonishment; for I violate no confidence in saying that I wrote to Mr. Dyas to learn what impediments he found in working the Act, and here is his reply, which, with his permission, I will read.

Mr. HONE DYAS.—I request Mr. Joynt to read my letter.

Mr. LANE JOYNT then read the following letter:—

"*Athboy, Nov.* 19, 1864.

"DEAR SIR,—Having been in the county of Longford, I did not receive yours until after post hour. To prove generally useful, the Drainage Act of 1863 must be amended. The great difficulty I have experienced in working it in the Athboy district is, as you suggest, under the money clauses; as it would appear that, in a strict legal point of view, a lender would have no security till the award be made, though I believe that in practice no difficulty would arise as to this; and if the rate of interest had not been so high, that we should have obtained the money easily. Still it is desirable that there should be no doubt as to the security previous to the award, and that all the lands in the district should be made provisionally liable. I think, also, the *maximum* rate of interest should be six per cent. The Board of Works should not have any priority over debenture holders; they should also have a *discretionary* power to lend more than half the entire cost, without insisting on the previous expenditure of an equal, or *any* sum. I fear it would be hopeless to look for an Act requiring them to lend all. Some of the procedure as to notices might be simplified, and time for objections, &c., shortened; and I do not see the necessity for an Act to confirm the provisional order; there are already provided sufficient safeguards to property without it, and it causes great delay, and puts it in the power of a single Member of Parliament, who might be the only dissentient proprietor, to throw it out, at least for the session, by taking advantage of the forms of the House.

"I have hastily written all that occurs to me; but I will most probably give myself the pleasure of hearing your paper.

"I am, Sir, yours faithfully,

"N. HONE DYAS.

"*Wm. Lane Joynt, Esq.*, 46, *Lower Gardiner-street, Dublin.*"

Now, I assert that Mr. Dyas's letter is a complete vindication of my views, and the best answer to his speech here to-night. But even if the money were lent to the Athboy district, and to seven or eight wealthy landlords, I say that is no precedent for the rest of Ireland. No lawyer in the Four Courts could or would advise money to be lent on a security not existing, dependent on the making of an award, and which if never made the lender would be, at last, compelled to try and get made by an injunction in Chancery. But even were the award made, what lender will submit to the subsequent mortgagees getting precedence over him? and, above all, what person having ten, fifty, or one hundred thousand pounds to lend, will receive it back by unequal and uncertain instalments of principal and interest? No doubt, Mr. Dyas has fallen into this grave error because he hopes to get some friendly lender to give him the money for the Athboy district; I sincerely hope he may get it; but, on the security of seven or eight proprietors, I do not see why, if they come forward and make themselves personally responsible, he should not get it. For my part, the drainage district with which I am most intimately connected, that of Six-mile Bridge, in the county of Clare, is situated in much the same way as that of Athboy. I feel sure that the Noble Lord for whom I act as agent (Lord Annaly) would not let the project drop: if I said—The security is doubtful, but I see my way to its repayment, and it is worth your while to serve the dis-

trict, and give employment, I feel sure the Noble Lord, who has ever at heart the good of his tenants and his country, would at once cheerfully place the money at my disposal; but that is not the security or the mode given in the Drainage Act, nor could I expect others to follow his example, when, instead of £8000 or £12,000, the works might require a quarter of a million, sterling. Sir, I think I have shown the defects of the Arterial Drainage Laws to be waste of time in the proceedings, and want of security and funds to carry on the works; and if I have succeeded in this, the remedy is plain. For my own part, I am well content with the proceedings of the evening; and I have, in conclusion, to express my acknowledgments for the criticism of an audience so friendly and discriminating.

XXIX.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

THE AUTHOR.

Brady (Cheyne, Esq., M. R. I. A.). The Training of Idiotic and Feeble-minded Children. 12mo. *Dublin*, 1864

THE REV. J. LONG.

. . . *Carnatic Catechism*, with Letter [by *C. Poorooshottum Moodeliar*] to their Graces the Archbishops, &c., &c., on the Carnatic Question. 8vo. *London*, 1862

THE AUTHOR.

Crory (W. Glenny, ...). Plain Directions to Practical Farmers on Flax Culture. 8vo. *Dublin*, 1864

THE PUBLISHER, MRS. DELIA WEEKES, 20, EUSTACE-STREET.

Dublin Review: Journal of Literature, Art, and Society. Vol. I, No. 2. [Dublin, June 1, 1864. Folio. *Dublin*, 1864

THE REV. BEAVER H. BLACKER, M. A., BOOTERSTOWN.

. . . *Dunciad*, variorum. With the Prolegomena of Scriblerus. . . 4to. *London*, 1729

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.

Elrington (Stephen N., Barrister-at-Law, . . .). The Martyrdom of Misdirected Genius. The Life and Character of Chatterton: a Lecture, delivered . . . June, 1864.

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.

Fitzgerald (Rev. William, B. A.). Episcopacy, Tradition, and the Sacraments, considered in reference to the Oxford Tracts, with a Postscript on Fundamentals. 8vo. *Dublin*, 1839

LORD CLERMONT.

Fortescue (Sir Faithful). An Account of . . . . . Sir Arthur *Chichester*, Lord *Belfast*, Lord Deputy of Ireland. With Notes, and a Memoir of the Author by Lord *Clermont*. Printed for private circulation. 8vo. *London*, 1858

THE AUTHOR.

Frazer (Dr. William, Lecturer on Materia Medica to the Carmichael Medical School). Treatment of Diseases of the Skin. 8vo. *Dublin*, 1864

THE CANADIAN GOVERNMENT.

Geological Survey of Canada. Report of its Progress from its Commencement to 1863; . . . . 8vo. *Montreal*, 1863

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.

Hartstonge (Matthew Weld, Esq.). Minstrelsy of Erin; or, Poems Lyrical, Pastoral, and Descriptive. . . . 8vo. *Edinburgh*, 1812

Horace. The Odes, Satyrs, and Epistles of Horace. Done into English by Mr. *Creech*. . . . The Sixth Edition. 12mo. *London*, 1737

THE REV. J. LONG.

Indian Missionary Preachers—their Qualifications. 8vo. *s. l.*, *s. a.*

THE AUTHOR.

Ingram (John K., LL. D., ...). Consideration of the State of Ireland: . . . . an Address . . . before the Statistical and Social Inquiry Society of Ireland, . . . November 18, 1863. 8vo. *Dublin*, 1864

THE AUTHOR.

Kinahan (G. Henry, . . .). On the Eskers of the Central Plain of Ireland. [Read before the Geological Society of Dublin, November 11, 1863.] 8vo. *s. l.*, *s. a.*

THE AUTHOR.

Kinahan (Henry, ...). On Crannoges in Lough Rea. [Read before the Royal Irish Academy on November 30, 1863.] 8vo.

J. B. LAWES, ESQ.

Lawes (John Bennet, Esq., F. R. S., ... of Rothamsted, Herts, and Joseph Henry *Gilbert*, Ph. D., . . .). The Rothamsted Memoirs on Agricultural Chemistry and Physiology.
. . . . Vol. 1, Field Experiments.
Vol. 2, . . . Feeding of Animals. 8vo. *London*, 1863

J. B. LAWES, ESQ.

Lawes' Testimonial Laboratory, Rothamsted, Herts, Drawings and Plans of. 4 plates. Long folio. *London*, *s. a.* [1863]

THE REV. J. LONG.

Letter [from the British Indian Association] to . . . . Sir Charles Wood [on the Punishment of Whipping in India]. Fol. *s. l.*, *s. a.*

THE AUTHOR.

Long (Rev. J.) . . . . Evidence explanatory of the Indigo System in Lower Bengal, ... 8vo. *Calcutta*, 1861

THE AUTHOR.

M'Evoy (John, ...). National Necessity for the Registration of Births, Marriages, and Deaths in Ireland. . . . 8vo. *Dublin*, 1863

JAMES HAUGHTON, ESQ., J. P.

Massie (James William, D. D., LL. B., London, ...), America: The Origin of her Present Conflict; . . . and her Claim for Anti-Slavery Sympathy; . . . . 8vo. *London*, 1864

FROM ——.

Mentor. Observations on the *Torrens'* Registration Scheme; . . . Proposed "Recording of Titles Act (Ireland)." 8vo. *Dublin*, 1864

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.

Minucii Felicis Octavius. Cum . . . notis . . . novâque Recensione Jacobi *Ouzelii* . . . . Johannis *Meursii* notæ, et liber Julii *Firmici Materni*, V. C., de Errore Profanarum Religionum. 8vo. *Lugduni Batavorum*, 1672

THE AUTHOR.

Mongan (Roscoe, B. A., . . .). The Practical Spelling Book, . . . Annotations from . . . Latham, Trench, Richardson, Worcester, etc. Second Edition. 8vo. *London*, 1862

THE AUTHOR.

Mongan (Roscoe, B. A.). The Practical English Grammar; . . . . Analysis of Sentences, Composition, &c. 8vo. *London*, 1864

L'AUTORE, In omaggio alla Società R. di Dublino, Commendatore Cristofero Nigri, Ministero degli Affari Esteri d'Italia: Trasmettitore, Illus^{mo}. Signor Prof^{e}. C. A. Marani, Console di S. M. il Re d'Italia a Dublino.

Negri (Christofero) Memori Storico-Politiche sugli Antichi Greci e Romani. 8vo, *Torino*, 1864

MR. W. B. WEST, U. S. Consulate, Dublin.

Our Foreign Relations: . . . Speech of Hon. Charles *Sumner*, . . . New York . . . Sept. 10, 1863. . . . 8vo. *Philadelphia*, 1864

THE COMMISSIONERS OF PUBLIC WORKS.

Oyster Fishery.—The Laws which regulate it in Ireland; . . . . . Means of overcoming Natural Difficulties in . . . the Propagation and Growth of the Oyster; . . . 8vo. *Dublin*, 1864

THE REV. J. LONG.

Pratt (Hodgson). Bengal Planters and Ryotts. (. . . . From the "National Review," January, 1862). 8vo. *s. l., s. a.*

THE REV. J. LONG.

Proceedings . . . . of the . . . . Corporation of Calcutta . . . . 7th March, 1864 . . . Baboo Ramgopaul Ghosès on . . . . Burning Ghats on . . . the Hooghly. . . . 8vo. *Calcutta*, 1864

THE REV. BEAVER H. BLACKER, M. A., BOOTERSTOWN.

Report of the Deputation appointed by . . . . the Irish Society to visit the City of London's Plantation in Ireland, in the year 1836. 8vo. *London*, 1836

THE AUTHOR.

Report of Dr. Mapother's Papers on . . . Public Health. . . . 8vo. *Dublin*, 1864

THE REV. J. LONG.

. . . *Report* of the late Native Meeting to vote Thanks to His Honor the Lieutenant-Governor [of Bengal]. Folio. *s. l., s. a.*

FROM ——.

Report of the Resident Medical Superintendent for the year 1863, Richmond District Lunatic Asylum. 8vo. *Dublin*, 1864

J. B. LAWES, ESQ.

Rothamsted Memoirs. From the "Philosophical Transactions." Reports of some Researches on the Chemistry of Animal and Vegetable Growth. [By *Lawes*, *Gilbert*, and *Pugh.*] 4to. *London*, 1863

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.

Smith (William, Esq.). The Patriot; or, Political Essays. . . . 8vo. *Dublin*, 1793

THE AUTHOR.

Smyly (Philip C., M. D., . . .). A Course of Lectures on the Use of the Laryngoscope, . . . Part 1. 8vo. *Dublin*, 1864

THE DIRECTORS OF THE ALEXANDRA PARK COMPANY, LONDON.

Views in Alexandra Park. [24 Plates, in Portfolio.]

THE AUTHOR.

Witt (George, M. D., . . .). A Compendium of Osteology; . . . Method of Preparing Bones for Osteological Purposes. . . . 4to. *London*, 1833

EDWARD CLIBBORN, ESQ. A. L., R. I. A.

Witt (Georgius, Anglus, . . . Chirurgus). Disputatio Medica Inauguralis De Cholera Epidemica Indiae Orientalis . . . pro Gradu Doctoratus . . . in Academia Lugduno Batava . . . 4to. *Lugduni Batavorum*, 1830

(Signed) EDW. RICHARDS PUREFOY COLLES,
Librarian.

December 31, 1864.

BOTANIC GARDEN.

Mr. BAXTER, *Botanic Garden, Oxford*:—17 kinds of Aquatic Plants.

Mr. MOORE, *Botanic Garden, Chelsea* :—37 kinds of Seeds.

Herr OTTO, *Botanic Garden, Hamburgh*:—127 kinds of Seeds.

Dr. CASPRAY KONIGL, *Botanischer Garten, Konigsberg* :—104 parcels of Seeds.

Miss BUNBURY, *Picton, Bunbury, Western Australia* :—6 kinds of rare Seeds.

DITTO :—3 kinds of Seeds.

DITTO :—16 parcels of Seeds.

J. HOWARD LOUCHE, Esq., and Mr. MILNE, *Old Calabar*:—Large package of Seeds of African Palms.

DITTO :—Two Wardian Cases, filled with rare and valuable Palms, &c.

W. H. BAILY, Esq., *Geological Survey of Ireland, Stephen's-green* :—6 kinds of Seeds from New Zealand.

DITTO :—Package of Australian Seeds.

Dr. DE RICCI, M. R. D. S. :—1 very valuable Orchideous Plant.

T. A. WHITE, Esq., *Ceahar* :—Seeds of Tea Plant.

G. A. POLLOCK, Esq., *Oatlands, Navan* :—28 kinds of Seeds from Japan.

W. TUKE, Esq., 14, *Clare-street* : —1 parcel of Seeds.

M. MOE, *Botanisk Garten, Christiania, Norway* :—100 parcels of valuable Seeds.

Herr ORTGIES, *Inspector, Botanischer Garten, Zurich* :—73 kinds of Seeds of Alpine Plants.

Dr. HARTE MILLER, through Dr. CARTE, M. R. D. S. :—3 kinds of Seeds from Australia.

The Right Hon. the LORD CHANCELLOR :—35 rare Pelargoniums.

Miss HAMILTON, *Greytown, Nicaragua* :—Large chest filled with Seeds, Plants, and articles of vertu, for Botanical Museum.

ROBERT MALLET, Esq., *London* :—Package of Seeds from Tasmania.

Rev. J. BEATY, 52, *Upper Leeson-street* :—3 papers of Fern Spores.

T. A. WHITE, Esq., *Garrycastle House, Banagher* :—Parcel of Roots from India.

Per Dr. HARVEY :—

W. T. GERRARD, Esq., *Natal* :—6 packets of Seeds from Natal.

Mrs. HILL, *Oatlands, Castleknock* :—18 kinds of Seeds from Madeira.

Mr. CLARK, *Royal Botanic Garden, Glasgow* :—12 valuable Plants, including the true Bread Fruit (*Artocarpus incisa*).

Dr. Paterson, *Bridge of Allan* :—1 valuable Fern.

Mr. Stirling, *Nurseryman, &c.*, 8, *Bernard's-row, Edinburgh* :—27 species of rare Alpine Plants.

W. Wilkie, Esq., *Phœnix Park* :—10 kinds of Seeds.

Mr. Dean, *Nurseryman, near Bradford* :—9 kinds of rare Plants.

Mr. M'Nab, *Royal Botanic Garden, Edinburgh* :—62 species of valuable Plants.

Mr. Bull, *Nurseryman, King's-road, Chelsea* :—15 species of new and rare Plants.

Herr Bouché, *Inspector, Botanic Garden, Berlin* :—17 rare and valuable Plants.

Dr. Harvey, sent by Mrs. F. W. Barber, *Natal* :—3 kinds of Seeds from Natal.

Mr. Peter Cleary, *Gibbinstown, Kilmallock, Co. Limerick* :—A bottle with fine full-grown Apple inside (very curious), for Museum.

R. Miniatt, Esq., *Annaghbeg House, Nenagh* :—Fronds of the rare *Trichomanes reniforme*, from New Zealand.

Mr. Riddings, 5, *Dawson-street* :—2 kinds of Seeds from New Zealand.

Dec. 31, 1864. (Signed) D. Moore, *Curator.*

NATURAL HISTORY MUSEUM.

Mrs. Thompson, 8, *Harcourt-road* :—A Model of an Indian Tent.

Captain Stokes, R. E., *Athlone* :—A Pike (*Esox lucius*).

Henry Hewitt, Esq., *Williamstown Avenue* :—Two Eggs of a Cockatoo.

Henry Peile, Esq., 42, *Fleet-street* :—Two Albatross Skins,—one of *Diomedea exulans*, the other of *D. culminata.*

Alexander F. Boxer, Esq., R. N., *Hong Kong, China* :—A small collection of Insects from China.

J. Metge Barry, Esq., M.D., *Leeson-street* :—A few Bird Skins; two Skulls of native Australians; and some Crustaceans from the Gulf weed.

Matthew Crawford, Esq., *Clonmoylan, Woodford, Co. Galway* :—The Skin of an Albatross (*Diomedea exulans*).

Richard E. Power, Esq., M. D., R. M. S., *Trent, St. Thomas's Island, West Indies* :—A small collection of Birds from the West Indies.

W. Harte Miller, Esq., M. D. :—Specimens of Auriferous Quartz, &c., from Victoria.

George Wade, Esq., *Ashbrook, Phœnix Park* :—A brown variety of the Rook (*Corvus frugilegus*).

MRS. OGILBY (per the Rev. J. H. TODD, D. D., S. F. T. C. D.):—An interesting collection of Shells, including the following genera:— Strombus, Murex, Conus, Turbo, Trochus, Natica, Nerita, Bulla, Bulimus, Helix, &c., and a few specimens of Corals.

Miss HAMILTON, *Nicaragua, Central America*:—A bottle containing two Snakes from Nicaragua.

ARTHUR HUBAND, Esq., M. R. D. S., 7, *Herbert-street*:—A portion of a Roman Tile, dug from under the foundations of the "Feathers," the oldest inn in Chester, and which was built on the site of a Roman bath.

SANDFORD PALMER, Esq., J. P., *Ballinlough, Roscrea*:—The Skeletons of a Donkey, a Sheep, and a Horse.

Rev. JAMES PEED, *Raheenduff, Foulkesmill, New Ross*:—A Turtle Dove (*Columba turtur*), shot at Raheenduff.

RICHARD WILLIAMS, Esq., 38, *Dame-street*:—Two young Ruddy Sheldrakes (*Anas rutila*).

Lieut.-General MAUNSELL, 26, *Herbert-place*:—An Indian Idol.

Rev. CHARLES MAYNE, *Killaloe, Co. Clare*:—A young Ruff (*Machetes pugnax*), shot on the Shannon.

(Signed) ALEXANDER CARTE, M. D., *Director*.

Dec. 31, 1864.

INTELLIGENCE.

NOVEMBER 16, 1864.

MR. GEORGE WOODS MAUNSELL, in the Chair.

MR. JAMES HAUGHTON read a paper, of which the following is an abstract:—

MR. CHAIRMAN AND GENTLEMEN,—Some members of our Society having said to me that they thought a Paper on Vegetarianism would give rise to an interesting discussion, which might prove useful, I now, at their request, propose to bring that singular and unpopular subject under your notice. If the question were popular, as it deserves to be, instead of being one which rather provokes the smile of contempt whenever it is introduced, it would not want able and scientific advocates among many men in the Royal Dublin Society who are eminent for their intellectual acquirements; so that what is really singular about the subject is, that it should devolve on a man of so little scientific knowledge as I possess to bring under the notice of this learned body, in a written communication, truths which have been long discarded in nearly all civilized communities, but which are nevertheless as old as man's creation, and which have, in ancient and modern times, found able and philosophic advocates among the wisest and the greatest names that adorn the history of our race—men whose memories have been handed down to us for ages, and whose works will, in the remotest future, be read with delight, because they will transmit from generation to generation such evidences of noble thoughts and culti-

vated genius as must always yield pleasure to the wise and good in the field of human improvement in every age. It is not denied that man can and does find nourishment for his system on animal food, or on a mixed regimen of flesh and vegetable food. Many of the purely carnivorous animals can and do exist on such a mixture; and herbivorous animals, which loathe animal food, have been known to live entirely on that regimen when they were deprived of their natural aliment. These facts prove nothing but that men and other animals can be brought to live upon food that is altogether foreign to their natural desires. What we vegetarians maintain is, that flesh is not the natural food for man, as it is not the natural food for the horse or the camel, or the monkey, or many other animals that could be named. The carnivorous animals—those animals that are intended by nature to prey on other living creatures—are all formed for that purpose; they have teeth and claws, which enable them to seize on their prey and to tear it to pieces, and they delight in blood. The pain they inflict on their victims causes them no unpleasant sensations. It is not so with man. Flesh in its natural state he revolts from, and blood is his abhorrence, and giving pain to other creatures is painful to him. The destruction of animals to glut his unnatural appetite for flesh he delegates to the butcher. If he had to do the bloody work himself, few indeed, in comparison with their present numbers, would be found followers of the doctrine that flesh is one of the necessaries for supply of man's omnivorous propensities. Vegetarianism does not simply mean an abstinence from the use of flesh—that is its fundamental principle; but it has higher aims, which are well expressed in the following extract from the "Vegetarian Advocate":—"By vegetarianism we do not imply a mere system of abstinence from eating the flesh of animals, for such a system has always been the practice of a vast majority of the human race; but by vegetarianism we mean that system which has been adopted by prophets and philosophers, at different periods of the world, as calculated to increase the freedom and consequent power of the intellectual and moral faculties; to prepare the mind to withstand temptations to immorality and crime; a systematic adherence to which, whatever may have been the first motive for its adoption, involves a desire to rise above sensuality in the scale of existence; to be devoted more and more to the cultivation and growth of the mind; which teaches us to abstain from flesh, because flesh eating is a sensual indulgence—a carnivorous, an unclean thing; because it is cruel to kill, opposed to true civilization, to justice, to mercy, to kindness, and to all those finer and nobler feelings which form the brightest ornaments to human character. It is the vegetarianism of the mind as well as of the body; it is the vegetarianism of Daniel the Prophet, when he wished his companions to be fair, comely, and wise; it is the vegetarianism of Pythagoras and Numa—of Plato, of Plutarch, of Franklin, of Swedenborg, of Newton, of Wesley, of Howard, and of such minds as these, whose lives are still held up as an example to our youth, and whose works form the foundation of much of the intellectual and moral education of the present day, and who are, in fact, the educators of civilized society." "All the most eminent naturalists and anatomists, as far as we know, are unanimous and positive in the opinion that the anatomical structure of the human body, as compared with other animals, places man with the frugivorous and not with the carnivorous animals;" and it quotes Linnæus, Daubenton, Gassendi, Sir Everard Home, Cuvier, Ray, Lawrence, Lord Monboddo, Bell, Lambe, and Dr. Sylvester Graham, of America. In his chapter on "Analytical Chemistry," Mr. Horsell controverts the doctrine that animal food is more nutritious than vegetarian, and he proves the statement to be without foundation. His chapter on "Human Physiology" is also triumphant in our favour. And I find in this chapter that idea borne out by the inquiries of Professor Forbes and others, at Edinburgh, who give the following results:*—

	Height.	Weight.	Strength.
English, ...	68·9 in. . .	151 lbs. . .	403 lbs.
Scotch, ...	69·0 ,, . .	152 ,, . .	423 ,,
Irish, ...	70·0 ,, . .	155 ,, . .	432 ,,

Here we find the Scotch and the Irish vegetarians surpassing the English flesh-eaters in

* I believe that Quetelet obtained similar results from his experiments.

strength, and weight, and height. So far as health is concerned, I can speak from my own experience. I was delicate in my youth, having outgrown my strength; my parents brought me to Dublin from my native place (Carlow), more than once, to consult the late Dr. Perceval on my case. For years, under his advice, I abstained altogether from the use of vegetables. Up to my forty-fifth year I was subject to much annoyance from dyspepsia. About that period of my life I adopted the practice of teetotalism, and some years after I became a vegetarian, since which time I have been generally in the enjoyment of good health; I am now in my seventieth year. I have given a fair trial to both systems. I am fully assured that the use of flesh is opposed to man's nature, that it is a great physiological error, and that he acts most in accordance with the laws of his being when he confines himself to a vegetable regimen. In his chapter on "National Histories," Mr. Horsell shows that the peoples who live chiefly or entirely on vegetables, and who have so lived in all ages, are and always have been far ahead of those whose food is principally composed of fish and flesh. I have been told by my relative, the Rev. Professor Haughton, that a large number of the sheep slaughtered (how painfully this brutal word brings to our view a bloody field of battle) in Dublin have diseased livers. Whether diseased meat is more injurious to man than that of cattle in a healthy state, I leave to learned doctors to decide. We, vegetarians, have found out a more excellent way; I advise you all to walk in it. Dr. Lees, of Leeds, has written well and forcibly on our subject. I make the following quotations from his work on the "Primitive Diet of Man:"—"After all the noise we have heard of the necessity of fat meat and tallow in low latitudes, Sir John Richardson, M. D., one of the arctic voyagers, says, 'that the servants of the Hudson's Bay Company are now finding out by experience that although wheaten bread does not give them adequate support, bread composed of maize flour, which contains ten per cent. of oily matter, answers every purpose, two pounds and a-half being fully equal in sustaining the capacity both for muscular exertions and for bearing cold, to the 8 lbs. of fat meat of the ordinary ration." The late J. S. Buckingham told me that the porters at Constantinople and Smyrna, living on coarse bread and fruit, could carry with ease heavy burdens such as no Englishman could lift. And, moreover, that the athletæ (vegetable-eaters) who came from the Himalaya mountains to Calcutta to exhibit their strength, were far superior in that respect to any Englishman that could be found. We shall never know the full capacity of the earth to yield sustenance for human beings until the rearing of animals for food is wholly dispensed with. Certain it is, Almighty God, ordaining herbs and fruit for the food of man, speaks not a word concerning flesh for two thousand years. And when after, by the Mosaic constitution, there were distinctions and prohibitions about the legal uncleanness of animals, plants of what kind soever were left free and indifferent for every one to choose what best he liked. But, let me ask, are not the lower orders of Irish, who live on potatoes and buttermilk, as strong as any race of men in Europe? They are vigorous even to a proverb. In the first missionary voyages to the South Sea Islands, we are told, that "until the Europeans visited the Otaheitans, they had few disorders among them. Their temperate and regular mode of life, the great use of vegetables, little animal food, and absence of all noxious distilled spirits and wines, preserved them in health. The case at present is wofully altered." "Fruits and Farinaceæ, the Proper Food for Man," by Mr. John Smith, is a work which goes at length into this subject; he is an ardent vegetarian, and I believe his reasonings are unanswered and unanswerable. The second edition was published in 1849. Time will not permit me to quote from this interesting work. I am well aware, Gentlemen, that want of time for preparation of my paper is not a reasonable excuse for its many deficiencies. Those who read papers before this Society—this institution, venerable from its antiquity—and yet more to be respected for the steadiness and success with which it has pursued its most useful objects, and which stands proudly as the pioneer of every other similar association in these kingdoms, should prepare them with all the care and intellectual ability they can bring to their subject; yet I may perhaps be permitted to offer, as some excuse for the want of proper arrangement of the various branches of my subject, that I accepted my task at the suggestion of a few Members of the Society only a few days ago. Such as it is, however, I offer you my paper on an unpopular but very interesting question, as some little evidence of my willingness to aid in making the Evening Meetings of the Royal Dublin Society ancillary to

the continued distribution of useful knowledge throughout these lands. Many will smile at my simplicity in endeavouring to induce men to relinquish what they consider the chief, or one of the chief, enjoyments of life. I would not willingly lessen the pleasures of our existence; I would do all in my power to increase and multiply them tenfold. But where health is not, life is deprived of much of its happiness; and, under our present mistaken system of dietetics, nearly every respectable house in the kingdom is an hospital for perhaps one half of every year. I would put an end to this sad state of affairs by that better system which I am now advocating, and thus add largely to the pleasures of human existence.

Dr. Shaw, F. T. C. D., said he did not think the experiments of Professor Forbes, of Edinburgh, referred to by Mr. Haughton, could be relied on as an argument in favour of the vegetarian theory. Professor Forbes did not experimentalize on men of the labouring classes, but on medical students, who were not addicted either to a vegetable diet or teetotalism. In a state of nature, man was a more beef-eater than a vegetarian. It was only when they came to a high state of cultivation that they found such philosophers as Pythagoras and Mr. James Haughton advocating a vegetable diet. The weight of scientific authority was in favour of mixed food, and was decidedly opposed to an exclusively vegetable diet; and the truth probably was, that the wealthier classes in these countries eat more flesh meat than was good for them, whilst the lower classes got scarcely any. He believed the statements of Professor Gamgee in reference to the amount of diseased meat consumed by the people of these countries were greatly exaggerated. He admitted the great utility of vegetables as an article of food; and all he objected to was the theory that an exclusively vegetable diet was that which was best adapted to all classes of men under all circumstances. He objected to the laying down of general rules for universal application, as opposed to science and experience.

Dr. Jacob characterized Mr. Haughton's paper as a laboured eulogy of a crotchet, and criticized several of his statements, with the view of showing that they were contradicted by experience, common sense, and physiological science. He dwelt particularly on the fact that the teeth and stomach of man showed that he was intended by nature to use a mixed food, and said experience had proved that those who used such food enjoyed the greatest amount of bodily health and labour.

Dr. Edward Haughton was of opinion that a vegetable diet was peculiarly adapted to men of studious and sedentary habits; but that those who took a more active part in the battle of life, who came into rude contact with the world, and underwent great physical and mental exertion, required more or less of animal food.

Mr. Ross, of the Hudson's Bay Company said, that in the Arctic regions human life could not be sustained on an exclusively vegetable diet. In those intensely cold districts men had an irresistible craving for animal food, especially in the form of fat and oil.

Mr. Mowatt made a very energetic speech in defence of vegetarianism, in the course of which he accused the speakers on the opposite side of ignorance of the subject. He said that, although he went through as much mental and physical exertion as most men—often working from nine o'clock in the forenoon until three o'clock the next morning, he enjoyed as good health, as sound lungs, and as much physical strength as the gentlemen who had appeared as the advocates of animal food that evening.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day. At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Friday,	29·880	58	60	58	60	37	W.	6	Many,	Broken,	·030	Changeable, like rain.
2 Saturday,	29·680	60	64	62	65	49	S. W.	7	Do.	Do.	·250	Thunder, heavy rain P. M.
3 Sunday,	29·740	60	64	62	66	40	S. W.	9	Do.	Do.	. .	Very fine day.
4 Monday,	29·800	62	63	62	65	41	W.	9	Do.	Do.	. .	Do.
5 Tuesday,	29·800	60	63	62	64	43	N. W.	8	Do.	Do.	. .	Fine, breezy day.
6 Wednesday,	30·060	69	71	70	72	44	W.	10	Few,	Do.	. .	Warm, sultry day.
7 Thursday,	30·200	63	66	65	69	43	N. W.	9	Many,	Do.	. .	Clear A. M., cloudy P. M.
8 Friday,	30·250	68	69	68	70	45	E.	10	Few,	Do.	. .	Warm, sultry day.
9 Saturday,	30·170	60	64	62	65	44	N. E.	9	Many,	Do.	. .	Fine, breezy day.
10 Sunday,	30·150	64	65	64	66	45	N. E.	8	Do.	Do.	. .	Cloudy A. M., clear P. M.
11 Monday,	30·170	67	70	68	70	46	N. E.	10	None,	. . . . . .	. .	Very warm day.
12 Tuesday,	30·140	68	70	68	71	53	N. E.	10	Do.	. . . . . .	. .	Do.
13 Wednesday,	30·100	62	64	62	65	45	E.	10	Do.	. . . . . .	. .	Do.
14 Thursday,	30·090	65	69	67	71	43	E.	10	Do.	. . . . . .	. .	Do.
15 Friday,	30·100	65	69	67	69	48	N. E.	10	Do.	. . . . . .	. .	Fine, breezy day.
16 Saturday,	30·130	69	73	72	73	48	E.	10	Do.	. . . . . .	. .	Do.
17 Sunday,	30·140	59	62	60	63	52	N. E.	1	Many,	Broken,	. .	Dull and cloudy.
18 Monday,	30·128	68	72	70	72	50	E.	10	None,	. . . . . .	. .	Very warm day.
19 Tuesday,	30·128	70	73	71	73	58	S. E.	10	Do.	. . . . . .	. .	Do.
20 Wednesday,	29·970	67	70	68	71	61	S. W.	0	Many,	Broken,	. .	Dull, and changeable.
21 Thursday,	29·740	66	70	67	70	60	S. W.	6	Do.	Do.	·170	Heavy rain A. M., thunder P. M.
22 Friday,	29·780	68	71	69	72	66	N. W.	8	Do.	Do.	·010	Fine, breezy day.
23 Saturday,	29·900	68	71	70	71	53	W.	10	Do.	Do.	. .	Do.
24 Sunday,	29·650	67	70	67	70	54	S. W.	2	Do.	Do.	. .	Dull and changeable.
25 Monday,	29·580	65	70	67	70	53	W.	10	Do.	Do.	. .	Fine, breezy day.
26 Tuesday,	29·920	62	65	63	66	53	N. E.	4	Do.	Do.	. .	Dull and gloomy.
27 Wednesday,	29·800	64	66	64	67	55	S. W.	2	Do.	Do.	. .	Do.
28 Thursday,	29·650	65	70	67	70	55	W.	4	Do.	Do.	·380	Gloomy and changeable.
29 Friday,	29·930	67	70	68	71	53	S. W.	6	Do.	Do.	. .	Do.
30 Saturday,	30·040	72	75	73	75	63	W.	9	Do.	Do.	·030	Fine, breezy day.
31 Sunday,	29·700	70	74	72	74	56	S. W.	4	Do.	Do.	. .	Very stormy day.
								231	Total Amount of Rain,		0.870 inches.	

AUGUST, 1864.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Monday,	30·030	61	66	64	69	52	W.	8	Many,	Broken,	·020	Strong breeze, changeable.
2 Tuesday,	30·150	61	63	61	65	54	N. W.	0	Do.	Do.	. .	Dull and gloomy.
3 Wednesday,	30·180	65	67	65	69	44	S. W.	8	Do.	Do	·040	Fine, breezy day.
4 Thursday,	30·150	66	70	68	70	45	S. W.	8	Do.	Do.	. .	Do.
5 Friday,	30·050	67	69	67	70	42	W.	6	Do.	Do.	. .	Dull and gloomy.
6 Saturday,	29·960	65	67	65	69	41	W.	7	Do.	Do.	·040	Fine, breezy day.
7 Sunday,	29·850	64	66	64	68	45	S. W.	2	Do.	Do.	·010	Gloomy A. M., rain P. M.
8 Monday,	29·920	62	66	63	67	46	N. W.	4	Do.	Do.	.100	Fine, breezy day.
9 Tuesday,	30·150	60	64	62	67	43	W.	3	Do.	Do.	. .	Dull and changeable.
10 Wednesday,	30·200	61	64	63	65	45	N. W.	8	Do.	Do.	. .	Strong breeze, fine day.
11 Thursday,	30·250	66	68	66	69	37	E.	8	Do.	Do.	. .	Do.
12 Friday,	30·270	65	68	67	70	37	E.	9	Do.	Do.	. .	Do.
13 Saturday,	30·300	66	72	68	73	42	S. W.	9	Do.	Do.	. .	Do.
14 Sunday,	30·300	70	74	72	75	50	N. W.	9	Few,	Do.	. .	Very warm day.
15 Monday,	30·190	71	74	72	74	47	N. E.	9	None,	. . . . . .	. .	Do.
16 Tuesday,	30·100	69	72	70	73	48	N. E.	9	Many,	Broken,	. .	Fine, breezy day.
17 Wednesday,	30·100	68	70	69	72	49	N. E.	6	Do.	Do.	. .	Changeable A. M., clear P. M.
18 Thursday,	29·950	61	65	63	68	52	E.	8	None,	. . . . . .	. .	Do.
19 Friday,	29·800	60	65	63	65	45	N. E.	9	Few,	Broken,	. .	Do.
20 Saturday,	29·730	58	60	57	62	36	W.	6	Many,	Do.	·070	Changeable A. M., rain P. M.
21 Sunday,	29·740	58	60	59	60	40	N. E.	8	Do.	Do.	. .	Fine, breezy day.
22 Monday,	29·750	57	61	59	62	44	E.	8	Do.	Do.	. .	Do.
23 Tuesday,	29·920	57	60	58	61	45	N. E.	6	Do.	Do.	·210	Heavy rain A. M., fair P. M.
24 Wednesday,	30·080	58	61	59	62	39	N. E.	4	Do.	Do.	. .	Changeable, like rain.
25 Thursday,	30·200	58	63	62	63	41	E.	8	Do.	Do.	. .	Showery A. M., fine P. M.
26 Friday,	30·330	61	63	62	64	37	S. E.	9	Do.	Do.	·030	Fine, breezy day.
27 Saturday,	30·100	57	59	57	60	45	S. E.	0	Do.	Do.	·030	Showery day.
28 Sunday,	29·950	63	66	64	67	56	W.	2	Do.	Do,	·140	Dull and changeable.
29 Monday,	29·700	57	61	60	62	55	S. W.	0	Do.	Do.	·120	Do.
30 Tuesday,	29·520	62	65	63	67	55	S.	0	Do.	Do.	·070	Strong breeze, and changeable.
31 Wednesday,	29·650	60	65	63	66	50	S. W.	8	Do.	Do.	·010	Breezy and showery.
								[illegible]	Total Amount of Rain		[illegible] inches	

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Thursday, ...	29·750	61	65	63	65	46	S. W.	8	Many, . .	Broken, . .	·040	Very stormy day.
2 Friday, ...	29·550	61	64	61	66	58	W.	8	Do. . .	Do. . . .	·060	Showery day.
3 Saturday, ...	29·520	60	63	60	65	54	W.	5	Do. . .	Do. . . .	·050	Do.
4 Sunday, ...	29·520	57	59	57	59	54	W.	2	Do. . .	Do. . . .	·050	Do.
5 Monday, ...	29·850	60	62	60	62	49	W.	6	Do. . .	Do. . . .	·050	Strong breeze, fine day.
6 Tuesday, ...	29·780	65	66	64	69	52	W.	0	Do. . .	Do. . . .	·380	Stormy, wet day.
7 Wednesday, . . .	29·720	65	67	65	68	50	S. W.	0	Do. . .	Do. . . .	·100	Heavy showers.
8 Thursday, ...	29·870	59	61	69	61	51	S. W.	0	Do. . .	Do. . . .	·020	Dull and gloomy.
9 Friday, ...	29·790	58	63	60	65	54	N. W.	6	Do. . .	Do. . . .	. .	Very stormy day.
10 Saturday, ...	29·710	56	56	53	57	49	W.	5	Do. . .	Do. . . .	·100	Showery day.
11 Sunday, ...	29·850	55	55	53	56	39	W.	5	Do. . .	Do. . . .	·020	Light showers, fine day.
12 Monday, ...	29·980	57	60	58	60	44	W.	8	Do. . .	Do. . . .	. .	Fine, breezy day.
13 Tuesday, ...	29·750	60	61	59	62	52	W.	5	Do. . .	Do. . . .	·010	Dull and changeable.
14 Wednesday, . . .	29·350	55	56	53	57	52	S. W.	4	Do. . .	Do. . . .	·140	Stormy and showery.
15 Thursday, ...	29·300	54	55	53	58	41	E.	2	Do. . .	Do. . . .	·060	Dull and changeable.
16 Friday, ...	29·200	55	56	53	59	37	E.	3	Do. . .	Do. . . .	·050	Do.
17 Saturday, ...	29·330	57	59	57	60	39	S. W.	4	Do. . .	Do. . . .	. .	Dull A. M., fine P. M.
18 Sunday, ...	29·450	56	57	55	57	49	S. W.	6	Do. . .	Do. . . .	·050	Fine A. M., showery P. M.
19 Monday, ...	29·790	55	56	54	56	44	N. W.	5	Do. . .	Do. . . .	·280	Do.
20 Tuesday, ...	29·600	59	62	60	62	45	S. E.	2	Do. . .	Do. . . .	·030	Dull and showery.
21 Wednesday, . . .	29·510	61	62	60	63	48	S. W.	6	Do. . .	Do. . . .	·050	Breezy, light showers.
22 Thursday, ...	29·600	56	57	55	60	51	W.	3	Do. . .	Do. . . .	·040	Showery day.
23 Friday, ...	29·780	60	62	60	63	47	E.	4	Do. . .	Do. . . .	·010	Breezy, light showers.
24 Saturday, ...	30·180	56	60	58	61	53	N.	3	Do. . .	Do. . . .	. .	Dull and changeable.
25 Sunday, ...	30·240	59	60	59	61	43	W.	6	Do. . .	Do. . . .	. .	Very fine day.
26 Monday, ...	30·180	63	66	64	68	42	E.	8	None, . .	. . . . . .	. .	Fine, clear day.
27 Tuesday, ...	30·180	62	64	62	65	55	S. E.	8	Do. . .	. . . . . .	. .	Do.
28 Wednesday, . . .	30·350	57	60	58	60	40	N. W.	4	Many, . .	Broken, . .	. .	Gloomy A. M., fine P. M.
29 Thursday, ...	30·180	63	66	64	67	40	W.	8	None, . .	. . . . . .	. .	Fine, clear day.
30 Friday, ...	30·090	56	57	55	59	53	E.	3	Many, . .	Broken, . .	. .	Dull and changeable.
								138	Total Amount of Rain,		1·590	inches.

OCTOBER, 1864.

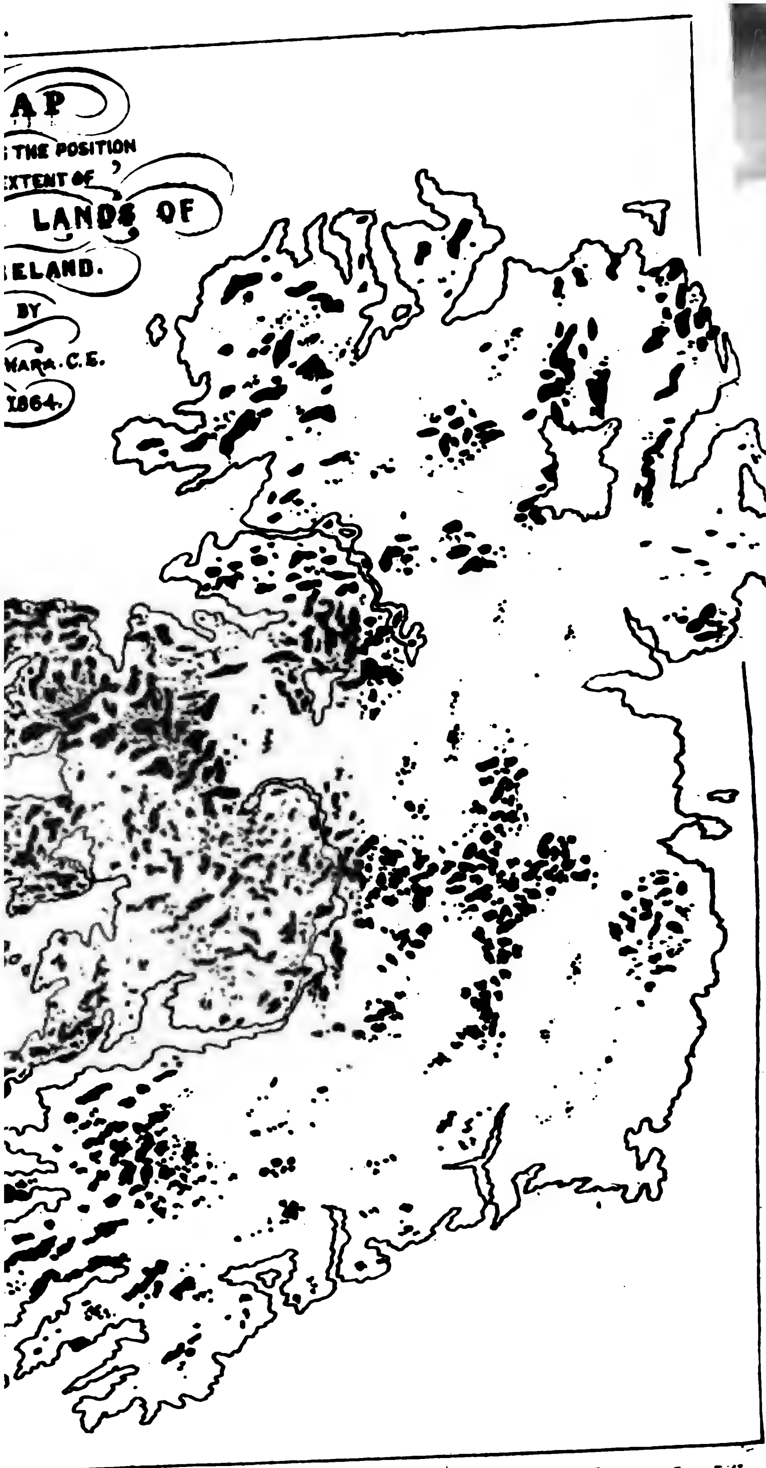
DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	THERMOMETER. Temp.	Dry.	Wet.	Max.	Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Saturday, . . .	30·150	55	53	52	55	42	E.	6	Few, . .	Broken, . .	. .	Fine, clear day.
2 Sunday, ...	30·220	53	54	52	57	46	E.	4	Many, . .	Do. . . .	. .	Dull and changeable.
3 Monday, ...	30·030	51	54	53	55	48	E.	6	Do. . .	Do. . . .	. .	Cold and breezy.
4 Tuesday, ...	30·020	53	54	52	55	46	N. E.	6	Do. . .	Do. . . .	. .	Do.
5 Wednesday, . .	30·120	54	54	52	55	45	E.	6	Do. . .	Do. . . .	. .	Do.
6 Thursday, . . .	30·280	54	54	52	55	37	E.	4	Do. . .	Do. . . .	. .	Do.
7 Friday, ...	30·100	54	56	54	57	39	N. E.	6	Do. . .	Do. . . .	. .	Calm, fine day.
8 Saturday, . . .	30·090	55	57	55	57	44	N. E.	7	Do. . .	Do. . . .	. .	Do.
9 Sunday, ...	30·200	52	52	50	55	42	N. E.	8	Do. . .	Do. . . .	. .	Do.
10 Monday, ...	30·400	51	53	51	54	44	N. E.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
11 Tuesday, ...	30·300	48	50	49	53	47	N. W.	0	Do. . .	Do. . . .	. .	Do.
12 Wednesday, . .	30·230	51	53	52	53	46	N. W.	0	Do. . .	Do. . . .	. .	Do.
13 Thursday, . . .	30·100	53	55	54	56	48	W.	0	Do. . .	Do. . . .	. .	Do.
14 Friday, ...	30·050	54	55	54	56	49	W.	2	Do. . .	Do. . . .	·010	Light rain A. M., fair P. M.
15 Saturday, . . .	30·050	51	53	52	55	49	W.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
16 Sunday, ...	29·730	51	52	50	54	41	W.	2	Do. . .	Do. . . .	·010	Showery A. M.
17 Monday, ...	29·450	49	51	49	53	40	S. W.	8	Do. . .	Do. . . .	·020	Showery day.
18 Tuesday, . . .	28·830	47	49	46	50	41	N. W.	2	Do. . .	Do. . . .	. .	Dull and changeable.
19 Wednesday, . .	28·800	46	47	44	47	40	N. W.	0	Do. . .	Do. . . .	1·570	Very wet day.
20 Thursday, . . .	29·220	45	45	43	46	40	E.	4	Do. . .	Do. . . .	·020	Showery A. M.
21 Friday, ...	29·130	45	45	43	47	38	N. E	0	Do. . .	Do. . . .	·600	Stormy, wet day.
22 Saturday, . . .	28·900	50	51	47	51	45	N. E.	0	Do. . .	Do. . . .	1·000	Do.
23 Sunday, ...	29·100	45	47	44	47	45	N.	0	Do. . .	Do. . . .	·360	Do.
24 Monday, ...	29·310	48	50	47	50	45	N. E.	0	Do. . .	Do. . . .	·240	Showery day.
25 Tuesday, . . .	29·370	44	45	43	47	41	N. E.	0	Do. . .	Do. . . .	1·640	Do.
26 Wednesday, . .	29·300	54	55	53	57	49	N. E.	2	Do. . .	Do. . . .	·020	Dull and gloomy.
27 Thursday, . . .	29·400	50	51	48	52	50	N. E.	0	Do. . .	Do. . . .	·410	Very wet day.
28 Friday, ...	29·490	51	53	51	53	50	N. E.	0	Do. . .	Do. . . .	. .	Gloomy, wet day.
29 Saturday, . . .	29·610	54	55	53	55	50	E.	4	Do. . .	Do. . . .	·070	Fair A. M., wet P. M.
30 Sunday, ...	30·000	49	50	49	50	49	E.	0	Do. . .	Do. . . .	·160	Dull and gloomy.
31 Monday, ...	30·150	47	48	47	50	46	E.	8	Do. . .	Do. . . .	. .	Fine, breezy day.
								70	Total Amount of Rain,		6·130 inches.	

NOVEMBER, 1864.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Tuesday, ...	30·180	48	49	47	50	39	S. E.	6	Few, . .	Broken, . .	. .	Fine, clear day.
2 Wednesday, . .	30·150	47	49	47	50	45	N.	4	Many, . .	Do. . . .	. .	Fine, mild day.
3 Thursday, . . .	30·324	45	46	45	50	31	N.	6	Few, . .	Do. . . .	. .	Clear, like frost.
4 Friday, ...	30·370	47	49	47	51	30	N.	0	Do. . .	Do. . . .	. .	Do.
5 Saturday, . . .	30·400	51	52	51	54	45	N. E.	0	Many, . .	Do. . . .	·080	Showery day.
6 Sunday, ...	30·650	45	47	46	49	41	S. W.	2	Do. . .	Do. . . .	. .	Dull and gloomy.
7 Monday, ...	30·200	43	45	44	47	29	W.	0	Do. . .	Do. . . .	·020	Cloudy, drizzling rain.
8 Tuesday, ...	30·180	46	48	46	48	33	N.	0	Do. . .	Do. . . .	·010	Do.
9 Wednesday, . .	30·180	44	45	44	49	36	N. E.	0	Do. . .	Do. . . .	. .	Dull and gloomy.
10 Thursday, . . .	29·970	43	45	43	46	35	N. E.	0	Do. . .	Do. . . .	. .	Do.
11 Friday, ...	29·820	42	42	40	45	36	S. E.	5	Few, . .	Do. . . .	. .	Fine, clear day.
12 Saturday, . . .	29·470	44	45	42	45	30	S. E.	0	Many, . .	Do. . . .	·010	Stormy day.
13 Sunday, ...	28·830	49	51	49	51	45	E.	0	Do. . .	Do. . . .	·200	Do.
14 Monday, ...	28·530	46	47	45	47	46	S. W.	0	Do. . .	Do. . . .	·720	Very wet day.
15 Tuesday, ...	28·950	44	46	44	46	46	N.	0	Do. . .	Do. . . .	·110	Dull and gloomy.
16 Wednesday, . .	28·700	46	47	44	47	40	W.	0	Do. . .	Do. . . .	·040	Do.
17 Thursday, . . .	28·700	47	50	47	50	35	S. W.	4	Do. . .	Do. . . .	·180	Showery day.
18 Friday, ...	29·100	49	50	48	50	39	N. W.	3	Do. . .	Do. . . .	·260	Do.
19 Saturday, . . .	29·320	46	48	45	49	40	W.	0	Do. . .	Do. . . .	.400	Do.
20 Sunday, ...	29·400	47	49	47	51	40	N. E.	0	Do. . .	Do. . . .	·560	Heavy rain P. M.
21 Monday, ...	29·600	50	51	49	51	34	W.	0	Do. . .	Do. . . .	·600	Gloomy A. M., clear P. M.
22 Tuesday, . . .	29·430	40	40	38	42	39	S. W.	3	Do. . .	Do. . . .	. .	Clear, like frost.
23 Wednesday, . .	29·400	40	40	38	43	35	W.	5	Do. . .	Do. . . .	. .	Do.
24 Thursday, . . .	29·200	35	35	33	38	28	W.	0	Do. . .	Do. . . .	. .	Dull and cloudy.
25 Friday, ...	29·020	39	40	38	42	28	S. W.	1	Do. . .	Do. . . .	.060	Frost A. M., rain P. M.
26 Saturday, . . .	29·050	40	41	39	42	35	S. W.	3	Do. . .	Do. . . .	·050	Strong breeze, very cold.
27 Sunday, ...	29·450	43	45	43	45	37	S. E.	0	Do. . .	Do. . . .	·090	Dull and showery.
28 Monday, ...	29·550	43	44	42	45	41	W.	5	Do. . .	Do. . . .	.100	Strong breeze, like rain.
29 Tuesday, . . .	30·010	49	49	48	51	35	S.	0	Do. . .	Do. . . .	. .	Breezy, and changeable.
30 Wednesday, . .	29·740	43	44	42	46	43	S. W.	4	Few, . .	Do. . . .	·360	Stormy A. M., clear P. M.
								51	Total Amount of Rain,		3·850	inches.

DECEMBER, 1864.

DATE.	BAROMETER.	THERMOMETER.					WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Thursday, ...	29·800	47	48	47	50	35	W.	0	Many, . .	Broken, . .	. .	Dull, and gloomy.
2 Friday, ...	30·080	49	50	49	52	39	S.	0	Do. . .	Do. . . .	. .	Do.
3 Saturday, ...	30·000	54	55	54	56	49	S. W.	7	Do. . .	Do. . . .	·040	Breezy, and changeable.
4 Sunday, ...	29·940	54	56	54	56	51	S. W.	2	Do. . .	Do. . . .	·030	Do.
5 Monday, ...	29·840	49	50	49	52	43	S. W.	6	Do. . .	Do. . . .	·100	Showery day.
6 Tuesday, ...	29·840	47	49	47	52	40	S.	4	Few, . .	Do. . . .	·040	Fine, clear day.
7 Wednesday, . . .	29·530	46	46	45	49	45	S. W.	0	Many, . .	Do. . . .	. .	Dull, and cloudy.
8 Thursday, ...	29·450	43	44	43	46	34	S. W.	0	Do. . .	Do. . .	. .	Do.
9 Friday, ...	29·640	37	37	36	39	29	S. W.	0	Do. . .	Do. . . .	·660	Frost A. M., overcast P. M.
10 Saturday, ...	29·600	47	49	48	49	34	S.	0	Do. . .	Do. . . .	·060	Hazy, mild day.
11 Sunday, ...	29·170	50	50	48	51	35	S. W.	0	Do. . .	Do. . . .	. .	Dull, and gloomy.
12 Monday, ...	29·240	45	46	44	47	39	S. E.	0	Do. . .	Do. . . .	. .	Dull, and changeable.
13 Tuesday, ...	29·400	45	46	45	48	41	S. E.	0	Do. . .	Do. . . .	·240	Showery day.
14 Wednesday, . . .	29·750	43	45	43	46	41	E.	0	Do. . .	Do. . . .	·030	Do.
15 Thursday, ...	29·660	40	41	40	41	38	E.	0	Do. . .	Do. . . .	·020	Dull, and mild.
16 Friday, ...	29·790	38	39	38	40	36	N. E.	0	Do. . .	Do. . . .	·040	Do.
17 Saturday, ...	29·830	37	38	37	39	34	N. E.	0	Do. . .	Do. . . .	·070	Cold, sleety showers.
18 Sunday, ...	29·690	30	30	30	32	29	N. E.	0	Do. . .	Do. . .	·400	Snow A. M., frost P. M.
19 Monday, ...	29·610	26	27	26	29	23	N. W.	5	Few, . .	Do. . . .	·040	Clear, like frost.
20 Tuesday, ...	29·890	42	43	42	44	22	N.	0	Many, . .	Do. . . .	·300	Dull, and mild.
21 Wednesday, . . .	30·100	36	41	39	42	28	N. E.	0	Do. . .	Do. . . .	. .	Dull, and gloomy.
22 Thursday, ...	30·170	40	41	40	41	36	S. E.	0	Do. . .	Do. . . .	. .	Breezy day.
23 Friday, ...	30·400	35	36	35	37	35	S. E.	0	Do. .	Do. . . .	. .	Dull, and cloudy.
24 Saturday, ...	30·400	33	34	33	35	29	N. E.	0	Do. . .	Do. . . .	. .	Fine, rather cold.
25 Sunday, ...	30·400	34	34	33	34	22	N. W.	4	Few, . .	Do. . . .	. .	Clear, and frosty.
26 Monday, ...	30·220	33	34	33	35	23	N. W.	6	Do. . .	Do. . . .	. .	Do.
27 Tuesday, ...	30·220	38	39	38	40	32	W.	6	Many, . .	Do. . . .	. .	Dull, and gloomy.
28 Wednesday, . . .	30·272	45	46	46	47	35	S. W.	0	Do. . .	Do. . . .	. .	Do.
29 Thursday, ...	30·100	43	44	43	46	42	S. W.	2	Do. . .	Do. . . .	. .	Do.
30 Friday, ...	29·830	42	42	41	45	41	W.	4	None, . .	. . . . . .	. .	Clear, like frost.
31 Saturday, ...	29·700	35	36	35	40	28	N. W.	6	Few, . .	Broken, . .	. .	Do.
								[illegible]	Total Amount of Rain, [illegible] inches.			



a. C.E. del. J. T. Landey Lith

TO ILLUSTRATE M^R O'HARA'S PAPER ON THE SUPPLY OF FUEL IN IRELAND.

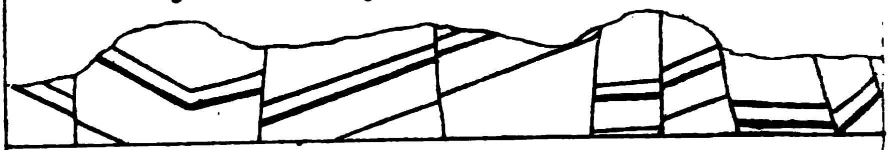
H O'Hara C.E. del *J.T. Landey. Lith*

TO ILLUSTRATE MR O'HARA'S PAPER ON THE SUPPLY OF FUEL IN IRELAND.

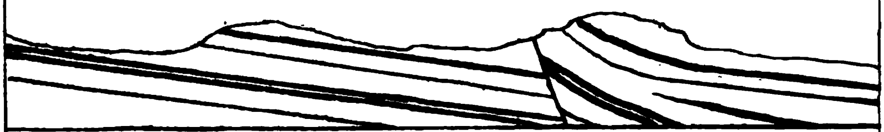
SECTIONS OF THE IRISH COLLIERIES.

Journal. R.D.S. VOL. IV. Plate. X.

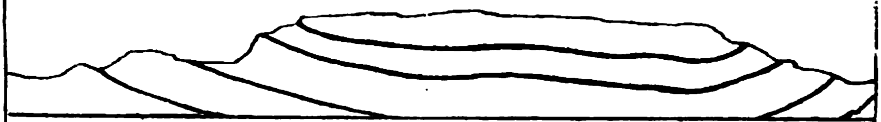
1. Ballycastle Colliery. Co. Antrim.



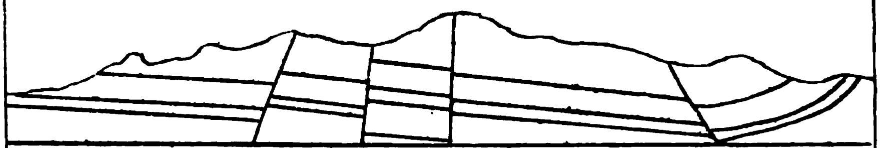
2 Coal Island Collieries. Co. Tyrone.



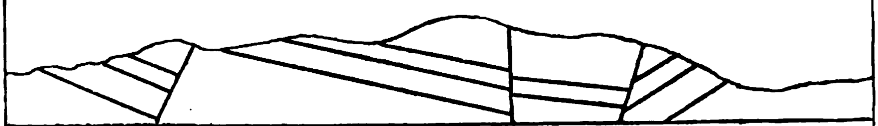
3. Bencroi Mountain. Co. Leitrim.



4. Kilronan Mountain. Co. Sligo.



5. Altagowlan Mountain. Co. Leitrim.



6. Castlecomer Colliery. Co. Kilkenny.

H. O'Hara C.E. del. J.T. Landey Lith

TO ILLUSTRATE Mr. O'HARA'S PAPER ON THE

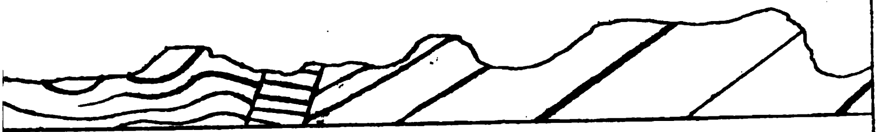
SECTIONS OF THE IRISH COLLIERIES.

Journal. R.D.S.

VOL. IV. Plate XI.

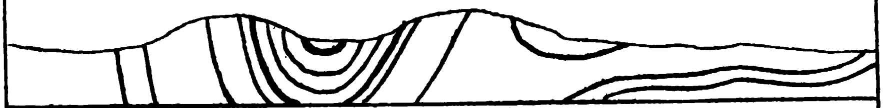
7. Coolbawn Hill, Co Kilkenny.

8. Queen's County Collieries.



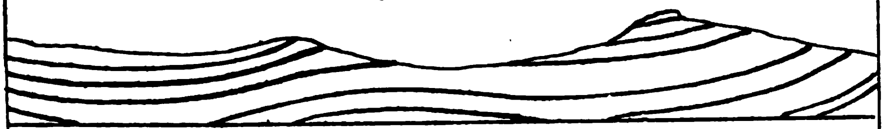
9. Limerick Collieries.

10. Earl's Hill Collieries Co Tipperary.

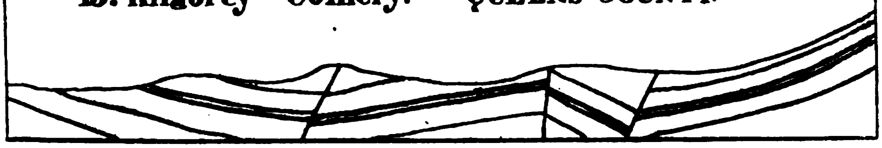


11. The Common's Collieries. Co Tipperary.

12. Bilboa Colliery. Queen's County.

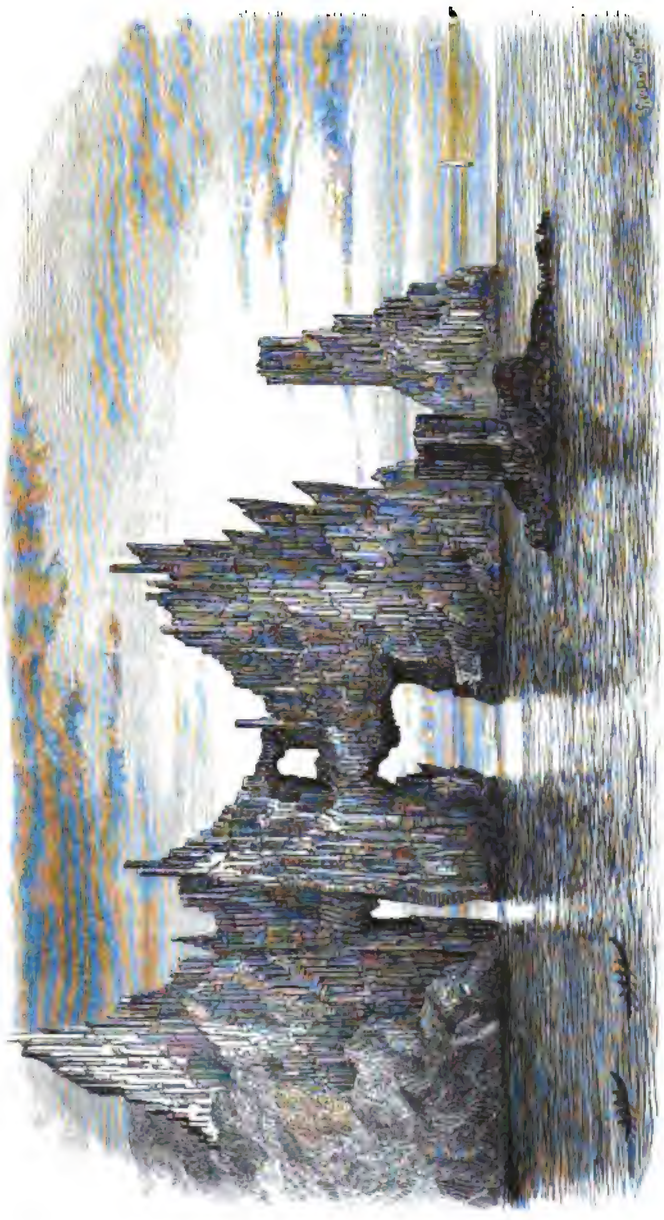


13. Kilgorey Colliery. Queen's County.



H. O'Hara C.E. del. *J.T. Landey Lith.*

TO ILLUSTRATE Mr O'HARA'S PAPER ON THE SUPPLY OF FUEL IN IRELAND.



No I.—TO ILLUSTRATE MR. ANDREWS' PAPER ON THE SEA FISHERIES OF IRELAND.

IV

No. XXXIV.] DECEMBER 1865. [Price 2

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

CONTENTS:

PAGE.

1. Dr. Cameron on the Fertilizing Value of the Sewage of Dublin, ... 397
2. Mr. Draper on the Construction of the Atlantic Cable, ... 418
3. Mr. Locke on Arctic Discovery, ... 419
4. Dr. Barry on Dr. Edmunds' System of Ventilation, ... 423
5. Dr. Barry on the Icebergs of the Southern Hemisphere, ... 431
6. Mr. Walker on the Chemical Value of Manures, and the Silurian Limestone of Courtown Harbour, County of Wexford, ... 440
7. Mr. Yeates on a New Table and Formula for Determining Altitudes with the Barometer, ... 444
8. Dr. E. Kennedy on the Neglect of Sanitary Arrangements, ... 446
9. Return of Donations to the Royal Dublin Society, ... 467
10. Intelligence, ... 475

Appendix—Meteorological Journal for the Months of January, February, March, April, May, and June, 1865, ... i

DUBLIN:

HODGES, SMITH, AND CO., 104, GRAFTON-STREET,

BOOKSELLERS TO THE ROYAL DUBLIN SOCIETY.

LONDON: SIMPKIN, MARSHALL, AND CO. EDINBURGH: JOHN MENZIES.

1865.

M. H. Gill, Printer to the Royal Dublin Society.

Royal Dublin Society.

FOUNDED 1731. INCORPORATED 1749.

The Society consists of Members, who, on being proposed and seconded, are elected at the next Meeting by Ballot, previously to which the Fees, as follows, must be lodged with the Registrar:—

Life Membership, ...	£21 0 0
Annual Membership (with £3 3s. Entrance Fee),	2 2 0

Annual Subscriptions due on 1st January. Persons in arrear on the 1st April cease to be Members.

Annual Members may at any time become Life Members upon payment of £15 15s.

I.—Meetings of the Society.

1. *Stated and Ordinary Meetings.*

The Society meets at 2 o'Clock P. M. on the First Thursday of each Month during the Session, from November to June, inclusive, and on the second Thursday in November.

2. *Evening Scientific Meetings.*

Meetings of the Society and of the Associated Societies, for the reading and discussion of Papers on Scientific subjects, are held on the third Monday in each Month during the Session. The business is conducted in the following sections:—

I. Agriculture and Rural Economy, and Horticulture.

II. Fine Arts.

III. Natural Sciences, including Zoology, Botany, Physiology, Mineralogy. Geology, Physical and Descriptive Geography.

IV. Experimental Sciences, including Physics, Chemistry, Physiology, Meteorology, and the Mechanical Arts.

Persons desirous to read Communications must submit their Papers to the Committee a week, at least, previously, for examination and approval.

The Copyright of all Papers read becomes the property of the Society; and such as are considered suitable for the purpose will be published in the Journal of the Society, and in the Quarterly Journal of Science.

Except under special circumstances, no person can be permitted to occupy the Meeting in reading a Paper for a longer period than half-an-hour; and the Society will not be held responsible for any opinions advocated in the communications read.

Each Subscriber of 5s. to the Refreshment Fund is entitled to Tickets, to admit Visitors, at 6*d*. each; or to twelve for 5*s*., available for any of the ordinary Meetings throughout the Session.

The Council and Committees.

The Council, which comes into office in January, meets during the Session at Three o'Clock on every Thursday not occupied by the Meetings of the Society.

Eight Standing Committees are annually elected, as follows:—1. Agriculture; 2. Botany; 3. Chemistry; 4. Fine Arts; 5. Library; 6. Manufactures; 7. Natural History; 8. Natural Philosophy. Besides these are the Evening Meetings Committee and Sectional and occasional Committees.

[*For continuation, see page 3 of Cover.*

THE JOURNAL

OF THE

ROYAL DUBLIN SOCIETY.

DECEMBER, 1865.

XXX.—*On the Chemical Composition and Fertilizing Value of the Sewage of Dublin.* By CHARLES A. CAMERON, M. D., *Analyst to the City of Dublin.*

[Read January 15, 1865.]

THE Sewage of towns, although hitherto but little used as a fertilizer of the soil, has at least proved the fertile subject of calm discussions, angry controversies, newspaper articles, lectures, scientific papers, pamphlets, reports, commissions, experiments, and even Parliamentary inquiries. The problem,—Can the Sewage of London be utilized? has occupied for the last twenty years the attention of capitalists, engineers, chemists, agriculturists, sanitary reformers, and imperial and civic legislators; but, notwithstanding all that has been said and done relative to this important problem, it still awaits a practical solution.

There are two points in relation to Sewage upon which the public have pronounced a positive and unanimous opinion—namely, the necessity for its complete and expeditious removal from the towns, and the desirability of subsequently turning it to good account by applying it to the soil. Every other aspect of the Sewage question is, however, regarded from different, and in many respects opposite, points of view. The engineers are not unanimous as to the best mode of conveying the Sewage from the towns to the points of distribution; the chemists have not accurately determined its composition; and even the agriculturists are not agreed as to the kinds of crops to which this manure is adapted, nor have they decided upon the proper quantities in which, under certain circumstances, it should be applied.

This, then, is the somewhat unsatisfactory condition of the Sewage question at a time when it comes prominently under the notice of the citizens of Dublin. The interest attachable to it is no longer confined to the inhabitants of London and those of a few other cities and towns across the Channel; for a project to utilize the Sewage of Dublin is actually afloat, and its promoters promise to be amongst the first to solve one of the most important social problems of this age. I am no more interested in the success of this scheme than every citizen of Dublin should be; and it is merely the statements in relation to it that have been made public that have led me to prepare a Paper on the Sewage of Dublin, which the Council of this Society have kindly granted me permission to read before its Members.

The question as to the practicability of using the Sewage of large towns for manurial purposes has for so long a period been discussed by so many able men, that but little originality need be expected in the present Paper. In fact, my chief object in reading it is simply to elicit a discussion by a competent assembly on a subject which is likely before long to affect the ratepayer of this city in a most sensitive, and hitherto very vulnerable, point, namely, his pocket. The gentlemen who propose to apply to a useful purpose the Sewage of Dublin are not, it would appear, disposed to undertake the collection of that article. They propose that it shall be delivered to them at points close to the estuary of the river; and they even go so far as to say to the citizens—we will not give you a farthing for all the Sewage you may give us, unless the profits which may result from its application pay us more than a fair percentage upon the capital embarked in the undertaking; in that case, we will divide our surplus profits with you. In order, therefore, to be in a position to comply with the terms of the Sewage Company, the Corporation must construct two huge sewers, parallel to or beneath the quays. The promoters of the Sewage Company appear to have been advised as to the probable cost of constructing these sewers, seeing that they propose lending to the Corporation for that purpose the sum of £80,000, at 5 per cent. The making of the intercepting sewers may or may not cost that large sum; but no doubt the outlay will certainly exceed £60,000.

The questions, then, which the citizens of Dublin are deeply interested in are—Firstly, is it desirable to prevent, at a cost of from £60,000 to £100,000, the Liffey from continuing to be an open sewer? Secondly, are the facts in relation to the application of Sewage such as would justify a reasonable expectation that the operations of the proposed Sewage Company would prove so remunerative as to be a source of revenue to the Corporation, as well as to the Company? These questions I propose to discuss in this Paper.

SANITARY ASPECTS OF THE SEWAGE QUESTION.

There is no doubt but that in the long run the agricultural and civic interests involved in the question of Sewage will be found to

coincide; but the *onus* of taking the first step towards the solution of this problem rests on the authorities of the towns. That agriculture sustains a loss so long as the sewage of towns is poured into the ocean, is quite true; but that loss is a mere negative evil, whilst the presence of this baneful stuff in the midst of a crowded city is a positive injury to its inhabitants. Are the citizens to tolerate the existence of an evil agent amongst them which annually sends no inconsiderable proportion of them to the grave, simply because those to whom that agent would prove a benefit do not take the trouble of coming for it? To the farmer the aspect of the Sewage question is simply a pecuniary one; and were he never to be supplied with the commodity, he would not, as a rule, be the worse off; but to the citizen the removal of the Sewage is a matter of life or death. I venture to assert, without fear of contradiction, that if this city were thoroughly sewered, and the contents of the sewers prevented from flowing into the river, the Registrar-General would have fewer deaths to record in his mortuary tables. Many of the diseases which prove fatal are the results of breathing an atmosphere rendered impure by exhalation from animal *ejesta*. A considerable proportion of the deaths which annually take place in Dublin proceed from what have been aptly termed preventable diseases. During the year 1864, 6200 persons died in this city, and of these five per cent. at least perished from maladies which the observance of strict sanitary precautions would almost completely exclude from our city. Last year the number of deaths amounted to 2·5 per cent. of the population. The Census Commissioners, in 1861, obtained returns from the registers of the cemeteries and graveyards in and near Dublin. From these returns it was found that there had been been buried annually for some years an average of 2·9 per cent. of the residents within the municipal boundaries. As the sanitary conditions of the city have evidently been somewhat amended of late years, this improvement in the state of the public health is easily accounted for; but in this respect much yet remains to be accomplished. If it be true, then, that the perfection of our incomplete sewerage system, and the preservation of the waters of our river from pollution, would annually prolong the lives of two or three hundreds of the inhabitants of this city, then, I say its Corporation would be justified, nay, more than justified, in incurring any reasonable expense in achieving objects of such vital importance. As a proof that I am not exaggerating the malign influence which the exhalations of open sewers exercise upon the public health, I need but refer to the case of Croydon. Some years ago the Sewage of this town was discharged into the River Wardle, the waters of which in consequence became so impure, that persons lower down the river could make no use of it for domestic or other purposes. Under these circumstances, some parties who possessed an interest in the water power afforded by the river instituted proceedings against the corporation of Croydon, with the view of compelling them to allow the river to pass unpolluted through the town. The corporation were

defeated; and after numerous unsuccessful attempts to deodorize the Sewage, they were at last obliged to lease 300 acres of land, for the purpose of pouring the Sewage over it, and getting rid of it in that way. They subsequently let the land thus irrigated at a rent of £300 per annum greater than was paid for it by themselves; but, owing to the lawsuits, and to the attempts to deodorize the Sewage by removing in a solid state its fertilizing matters, this practical solution of the Sewage question unfortunately cost the people of Croydon no less than £40,000 for an income of £300 per annum. In one respect, however, and that a most important one, this mode of disposing of their Sewage has been productive of the happiest consequences; for it is stated that the annual death-rate in their town and the adjacent districts immediately after sensibly declined. Here, then, we have the best evidence—that afforded by accurate statistics—to show that the thorough and speedy removal of the Sewage of a town promotes in a remarkable manner the longevity of its inhabitants.

Since the subject of the waste of the excrementious matters produced in towns began to attract public attention, many persons have suggested the complete separation of the liquid and solid *excreta* of men from the fluid which converts them into Sewage. All the attempts—and they have been many and costly—to separate the valuable ingredients of Sewage from the water in which they are in so excessively diluted a condition have failed. Nearly ninety per cent. of the solid matter dissolved in the Sewage cannot be precipitated from it by other than processes so costly as to totally preclude their economic application. But, then, it may be urged—why mix the valuable animal fertilizers produced in the city with so prodigious a volume of water? why deprive agriculture of so useful and so portable a manure? I answer—To the citizen sanitary considerations are primary considerations; it is impossible to remove excrementitious matter from our houses unless by mixing it with abundance of water. I am, therefore, totally opposed to the suggestion so constantly made, to treat our liquid and solid *ejesta* after the manner of the Chinese. In the Celestial Empire, as travellers tell us, altars to Cloacina, at which visitors as well as the inmates may worship, form a conspicuous object in the dwellings of the inhabitants; and certain operations of nature, which in the rural parts of this country are usually performed beneath the shelter of a friendly hedge, are in the "Flowery Land" conducted upon the road sides, and with appliances provided by the nearest farmer. Something like this system of manure preservation is to be found in Belgium; but I believe it will never prevail in these countries, where it is so much opposed to all our notions of sentiment and decency, the tendency of which is to keep such matters as much as possible in the background. It would be far better that every particle of fertilizing matter produced in this city should continue to be discharged into the thankless ocean, rather than that we should revert to the old system of privies and cesspools. It has been suggested that water-closets communicating with sewers should be

completely done away with; and that the excrements, liquid and solid, should be received into close vessels containing earth, or some other deodorizing substance. In this way, it is contended by those possessed of that dangerous kind of lore, a little learning, the valuable manure produced in cities may be rendered innocuous and portable. Leaving out of the question such a consideration as the enormous quantity of earth which would be required to supply the wants of the 25,000 houses constituting this city, it may fairly be doubted that such a plan would pay its own expenses. In the city of Manchester the system of cesspools still largely prevails. The Corporation discharge the duty of emptying these cesspools, and at a cost to the city of about £20,000 per annum. Of this large sum about £10,000 are recoverable by the sale of the manure; but still the large deficit of £10,000 remains. I believe, then, that if our Corporation undertook to remove the contents of the privies and cesspools that still remain in the city, they would find their operations in that line anything but profitable. There is no doubt but that the present mode of getting rid of the waste matters produced in Dublin is incomparably superior to the old plan of cesspools; and any one who takes the trouble of studying this question will see that in every city in England in which there is no system of sewers, the rate of mortality is very high. Since the abandonment of the cesspool system in London, the public health in that city has wonderfully improved.

The citizens of Dublin have incurred very heavy pecuniary liabilities in their desire to procure a plentiful supply of pure water; and I have no doubt but that their health will benefit by that display of liberality. But I firmly believe that the question of good sewerage is of greater importance than any that has arisen with respect to the relative qualities of the Vartry water and that furnished by the Canals; and to me it is quite clear that the sanitary state of Dublin must continue defective until every house in it communicates with a great central drain, and the waters of the Liffey pass undefiled through the city.

FERTILIZING PROPERTIES OF SEWAGE.

With respect to the fertilizing value of Sewage, I may say at once, that I am one of those who believe it to be very great, when applied under certain conditions, which I will presently indicate. It has failed to satisfy the expectations of some people, who had previously entertained a high opinion of its efficacy; on the other hand, many who doubted its utility have lately seen good reason to change their opinion. I will now briefly describe the results of the use of Sewage in a few of the places in which it has gotten a fair trial. The Sewage of the old part of the city of Edinburgh has for a long period of time been employed for irrigating meadows; and the grass farm of Mr. Miller, at Craigentinny has for many years been held up as an example of the wonderful ferti-

lizing power of Sewage. This farm consists of 250 acres of land reclaimed from the sea, and which at one time was only worth 4*s.* or 5*s.* an acre. Over this farm the Sewage derived from a district inhabited by 80,000 souls is poured. Nothing save grass is grown; and the amount of the produce which it is stated is annually obtained is almost incredible: three or four, and even six heavy crops have been obtained in one year, and that, too, in a rigorous northern climate. The Craigentinny meadows are let to the dairymen of Edinburgh, at an average rent of £22 per acre. With respect to the disposal of its Sewage, Edinburgh is far more favourably situated than any other large city in the empire; its site being much higher than the surface of the surrounding country, the mere force of gravity conducts its Sewage to the meadows which it irrigates. Formerly about 2000 acres were irrigated by the Edinburgh Sewage, but the spread of buildings and other causes have reduced that number by more than one half.

At Rugby, Sewage has been applied to agricultural purposes for some years past; and Mr. Walker, a gentleman in the neighbourhood, receives the whole amount produced in the town, for which he pays a rent of £50 per annum. In 1861 a committee was appointed by the Royal Commission on the Sewage of Towns to experiment at Rugby. The object was to determine the quantity and composition of grass produced on land, a portion of which was to be manured with Sewage, and another portion to remain unmanured. Fifteen acres were divided into three equal parts—one for grass, to be given to oxen; the second, for grass, on which cows were to be fed; and the third was to be meadowed. Each of these five acre divisions was further subdivided into four plots, one of which was left unmanured, and the others received respectively, 3000, 6000, and 9000 tons of Sewage; some of the results obtained are tabulated in the following Table:—

Produce given to Oxen.

Plot.	Sewage required per Annum.	Actually applied to end of October.	Total Grass per Acre.				Increase of Grass per 1000 tons Sewage applied.			
			tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
1	—	—	9	5	3	5	—	—	—	—
2	3000	1872	14	16	3	8	2	19	1	7
3	6000	4423	27	1	0	10	4	0	1	9
4	9000	6153	32	16	3	8	3	16	2	9

On the grass given to the milch cows the effects of the Sewage were still more favourable, as will be seen in the following Table:—

Sewage applied.	Number of weeks the produce kept a Cow.	Gallons of Milk per Acre.	Value of Milk at 8*d.* per gallon	Value of Milk from increased Produce of 1000 Tons Sewage.
			£ *s.* *d.*	£ *s.* *d.*
—	19	321	10 14 3	5 0 0
1387	40·9	570·7	19 0 6	5 19 10
2804	58·8	820·4	27 6 11	5 16 8
4226	68·9	961·3	32 0 10	5 0 11

In these trials it is shown that the application of Sewage was attended by a very great increase in the produce of grass. "Deducting the value of the milk produced from the grass of the unsewaged from that from each of the sewaged acres, reckoning it at 8*d.* per gallon, it appears that where about 1400 tons of Sewage were applied during seven months, the produce calculated, for each 1000 tons of Sewage actually applied, gave an increased amount of milk to the value of £5 19*s.* 10*d.*; where twice that amount of Sewage was applied, £5 18*s.* 8*d.*; and where three times the quantity, £5 0*s.* 11*d.*" The value of the milk obtained from an acre of unsewaged grass was only £10 14*s.* 3*d.*, whilst from the most highly sewaged grass the value of the milk amounted to no less than £32 0*s.* 10*d.* The Rugby experiments, which were conducted under the direction of Mr. J. B. Lawes—so well known for his invaluable chemico-agricultural investigations—have been considered somewhat unsatisfactory, on the ground that the Sewage was not always applied at the proper time; and Mr. Walker states that the fields were flooded to such an extent as to seriously deteriorate the quality of the herbage. Mr. Lawes admits that the experiments were in some respects so conducted that the results would not appear so favourable to the Sewage as under proper conditions would have been the case; but still the great fact remains, that land abundantly sewaged is capable of producing three times as much milk as the same kind of land when unsewaged.

The Sewage of the small town of Ashburton, in Devonshire, is distributed over the greater part of a valley which lies close to the town. The sewaged portion of the valley lets at the rate of £6 per acre, whilst the rent commanded by the unsewaged field at only £1 per acre.

The Sewage of Mansfield is poured over lands in the vicinity of the town, which in consequence have been raised in value from 3*s.* per acre to £12 per acre.

The Sewage of Carlisle, of Leicester, and of two or three other towns, are applied to the useful purpose of fertilizing the soil; and although pecuniary failures in some instances have arisen through futile attempts to concentrate the Sewage, or to distribute it over too wide an area, still in every case the remarkable manurial power of the article was strikingly exhibited.

On the Continent the Sewage of towns is in several places utilized on a large scale. Some time ago, our Government appointed a Commission, composed of Messrs. Way, Austin, and Southwood Smith, to draw up a report on the system of irrigation followed in the North of Italy. In this report it is stated that the Sewage of the city of Milan is employed in irrigating about 4000 acres of land, situated at a distance of a few miles from the city. Each acre receives annually about 9000 tons of Sewage, in which are contained the *ejesta* of forty persons. This land possesses an extraordinary degree of fertility; and becomes so charged with rich organic matter, that its surface is periodically pared, and the parings used to manure other lands not so favourably circumstanced. A Dr. Chiappa has a farm of 580 acres, near Milan, which is manured with the Sewage of the city. The portion devoted to grass contains eighty acres, yielding annually twenty-two tons of produce per acre. The grass is partly made into hay, partly consumed in the green state, and is found sufficient to maintain 100 cows. It is calculated that the 9000 tons of Sewage applied to each acre are equivalent to £4 8*s*. worth of well decomposed manure; but it must be observed that the Sewage of Milan is commingled with the waters of the River Vettabia, and is consequently much more dilute than the Sewage of Dublin. The conclusions at which these Commissioners arrived were chiefly as follows:—That the experience of the application of Sewage in the neighbourhood of Milan affords a striking illustration of the immense advantage which the command of large quantities of mere water alone confers upon agriculture; that the fertilizing virtues of the water are enormously increased by the addition of Sewage, and by its temperature being raised by its passage through a town; that the health of the population of the districts manured with Sewage is not worse than that of the population of regions in which pure water irrigation is carried on; that, notwithstanding the elevated temperature of Italy, no disagreeably odorous emanations arise from the sewaged fields; and, finally, the Commissioners condemn in very decided terms the folly and extravagance of the British people, who by most expensive arrangements seek to get rid of a manure which ought to be equivalent to the annual importation of many hundred thousand tons of guano.

With respect to the application of Sewage derived from manufactories, public institutions and other large establishments, and villages, there is abundant evidence to show that the general results have been very satisfactory. Alderman Mechi states that the use of Sewage on his celebrated farm at Tiptree Hall proved highly productive and remunerative. The Earl of Essex has constantly employed Sewage manure since, I believe, 1857, and with an extraordinary degree of success. This nobleman states that he has obtained from sewaged meadows the large produce of forty-six tons per acre, whilst from the same quality of meadows which had not been sewaged the produce amounted only to from seven to eight tons. On the Earl of Essex's farm an application of 270 tons of Sewage per acre of mangels produced a yield of forty-three tons, or about double

the average produce of that crop in England. Even in the case of market gardens, the use of Sewage has proved profitable. In the number of the "Irish Farmer's Gazette" for August 27th, 1859, Mr. R. O. Pringle gives an interesting account of the results of the application of Sewage at Mr. Niven's celebrated garden farm, Drumcondra, county of Dublin:—"The system of liquid manure which has been adopted at this farm is very simple. At the upper end of the field there is a large tank, which is kept full of liquid manure of the richest description, derived from the High Park Reformatory. Before Mr. Niven got this portion of the ground all the Sewage from that establishment was discharged into an open ditch, and was in fact a great nuisance, as well as likely to prove prejudicial to the health of the inmates. By an arrangement with the managers of the institution, Mr. Niven was permitted to throw pipes across the old ditch, and convey the Sewage into his tank; and some idea of its value will be gathered from the fact, that the consumption of soap alone in the Reformatory is nearly a ton a week, producing an immense quantity of suds, which, with other materials, combine to form a most valuable manure."

At the time of Mr. Pringle's visit, there was a fine crop of Kemp potatoes which had been manured with Sewage only, and which up to the 11th August had furnished eleven and a half tons per acre, a considerable quantity still remaining in the ground. When we consider that market gardens require the largest supplies of manure, and that those in the neighbourhood of London sometimes receive 120 tons of natural manure per acre, I think the case of the garden farm at Drumcondra indisputably proves that Sewage is capable of fully supplying the wants of every kind of crop. This morning I received a letter from Mr. Niven, in which he states that he continues to use the Sewage, in conjunction with a small proportion of stable manure, and that he even applies it to fruit-bearing trees. He says that its effects on the vine and peach trees are "amazing." Here, then, we have a nursery and market garden, consisting of thirty acres, maintained in the highest state of fertility by the Sewage derived from a single establishment, the members of which do not exceed eighty in number.

THE MOST SUITABLE CROPS AND SOILS FOR SEWAGE.

With respect to the kinds of crops to which Sewage is best adapted, it appears to be admitted on all sides that the natural and artificial grasses are those which have hitherto been most benefited by its application. There are, however, on record the results of experiments which go far to prove that Sewage may, under certain circumstances, be usefully applied on tillage farms. As a general rule, the constituents of a manure are rendered more efficacious by dissolution in large quantities of water, because they are thereby certain to be equably distributed throughout the soil, and each of the plants they are intended to nourish will obtain its fair share. The advantages of using manure in the form of a dilute solution are clearly shown in Mr. Ruston's Paper, in the 20th volume of the "Journal of the Royal Agricultural Society of England."

This gentleman obtained a large increase in all his crops—grass, green, and white—by simply applying the manure for each acre mixed with about 4000 lbs. weight of water. As a general rule, however, I believe that Sewage, which is an excessively dilute solution of manure, cannot be employed to any great extent on tillage farms, more especially on those that are not thoroughly drained. Light or medium soils, resting on a sandy subsoil, will be found the best absorbents of Sewage, although their power of retaining its fertilizing ingredients is not so great as that of heavy clays. On stiff clay lands, the chief fault of which is their impertransible nature, large dressings of town Sewage would not be beneficial, nay, would be the reverse. The fluid would rest on the surface, and render the soil so cold, and wet, as to be decidedly injurious to most plants. Land of any kind under cereals cannot constantly be the scene of Sewage irrigation; for during the long period of the year devoted to the preparation of the ground, a dry and easily pulverulent condition of the staple is desirable; and during the ripening of the crop, heat and a very moderate degree of humidity are necessary. It is clear, then, that cereal crops could only be benefited by very moderate doses of Sewage, applied at only certain periods of the year. Still, where Sewage is available, I believe that both white and green crops would be largely served by its use; and if it were in a more concentrated condition than that derived from large towns is, it might be applied during by far the greater part of the year. The use of dilute Sewage on a tillage farm being therefore very restricted, it would be unwise to attempt to supply the tillage farmers of a wide area with the drainage of a city like Dublin. Gas companies often find it unprofitable to lay down pipes to certain districts remote from their works, although their commodity is sold at the rate of 4*s.* to 5*s.* per thousand cubic feet: it would be still more unwise were Sewage utilization companies to attempt the laying down of pipes over a wide district in order to supply an article at the rate of only 1*d.* or 1½*d.* per ton. Grass lands, are in a very different condition with respect to Sewage: they are ready at almost any time for the reception of this manure; and their produce is, within certain limits, proportionate to the amount of Sewage applied.

PROPER QUANTITY OF SEWAGE TO BE APPLIED PER ACRE.

With respect to the proper quantities of Sewage to apply to grass, considerable variety of opinion prevails. Very different estimates have been made relative to the actual quantity which annually flows over the Craigentinny Meadows. Mr. James Hope sets it down at 2000 tons per acre; Mr. Miller states it to be 4000 tons; the late Mr. Austin, C. E., estimated it at 8000 tons; whilst Professor Anderson considers it to amount to 14,000 tons. As these meadows receive the Sewage of a district inhabited by 80,000 persons, Dr. Anderson's estimate is probably the nearest to the truth. It is quite certain that the Edinburgh meadows receive enormous quantities of Sewage, which do not appear to have exercised any peculiar effect on the quality of the grasses grown thereon, ex-

cept in rendering them exceedingly succulent. This disproves the statement made by certain writers, that large doses of Sewage render the herbage of meadows very coarse and inferior. No doubt, in the case of retentive and undrained soils, continued floodings of either Sewage or pure water would render the herbage coarse, but where provision is made for the moderately rapid passage of the liquid throughout and from the soil, very large quanties of Sewage will not injuriously affect the herbage grown upon it. Several authorities upon this subject contend that moderate dressings of Sewage—from 2000 to 5000 tons per acre, per annum—give in the end better results than excessive applications; whilst Mr. Lawes states in his evidence before the Select Committee on the Sewage of Towns, that if he got it for nothing, he would apply 70,000 tons of Sewage to an acre, or, he adds, "anything you like to give me." Mr. Westwood, late farm bailiff to the schools at Annerley, stated before the committee that he obtained as large a return from two acres of rye grass, to which 1500 tons of Sewage had been applied per annum, as from two other acres which had been manured with between 8000 and 9000 tons. As this witness had been obliged to furnish accurate returns relative to the farm under his management to the Government Inspector, the Select Committee appear to have attached great weight to his evidence. It appears to me that the pouring of 20,000 or 30,000 tons of Sewage over an acre of grass is a useless expenditure of the greater part of the fertilizing matters contained therein; and I have no doubt but that the Craigentinny meadows would yield as good crops as they do at present, were their supply of Sewage curtailed by three-fourths of its amount. The evidence given in the Second Report of the Select Committee on the Sewage of Towns is certainly, on the whole, in favour of light dressings as against heavy floodings.

COMPOSITION AND VALUE OF THE SEWAGE OF DUBLIN.

In relation to the chemical composition and fertilizing value of Sewage, the greatest variety of opinion prevails, especially with respect to the latter point. Some place so low a value as ½*d.* per ton upon the article, whilst others estimate its money value at from 1*d.* to 9*d.* per ton. Sir Charles Fox believes it to be worth 1½*d.* per ton; Dr. Hoffman sets it down at 2*d.*; and Mr. Lawes says that if obliged to take it at all times he would not like to give ½*d.* per ton: whilst Alderman Mechi estimates the value of the water alone for irrigating purposes, at 2*d.* per ton. In 1857, I made several analyses of the Sewage of Dublin, the results of which are published in my work on "Agricultural Chemistry."* From these analyses, I estimated the money value of the Sewage to be somewhat less than 1¾*d.* per ton. It is very difficult to arrive at an accurate knowledge of the composition of the Sewage of a large city, owing to the many disturbing influences which affect it. The rain-fall, the supply of water in each locality, the food of the inhabitants of the district, and

* "Chemistry of Agriculture." Dublin: Kelly, Grafton-street. 1857.

the hour at which the article is collected, are all important points, which must be taken into consideration, in estimating the average value of a ton of Sewage. Quite recently I have made an analysis of Sewage consisting of a mixture of no fewer than forty samples, selected at different hours during both day and night, from different sewers at their outlet into the river. I find on comparing the results of this analysis with those obtained in 1857, that there exists a close agreement between them.

According to the results obtained by my last analysis, 100 tons of the Sewage of Dublin contain the following fertilizing ingredients :—

1st.—In Complete Solution—

	Pounds.				Money Value.		
Nitrogen,	16·50	at	£70	per ton	£0	10	3·75
Phosphoric acid,	8·85	„	40	„	0	1	4·50
Salts of Potash,	5·12	„	20	„	0	0	10·97
Salts of Soda,	16·63	„	£1 10*s.*	„	0	0	1·78
	42·10			Total,	£0	12	9·00

2ndly.—Mechanically suspended—

	Pounds.				Money Value.		
Nitrogen,	2·48	at	£70	per ton	£0	1	6·60
Insoluble Phosphate of Lime,	1·84	„	8	„	0	0	1·57
Organic matter,	14·00	„	0 10*s.*	„	0	0	0·75
	18·82			Total,	£0	1	8·92
Total,	60·42			Grand total,	£0	14	5·92

The Sewage, the analysis of which I have stated above, was collected on three consecutive days; and I find, by reference to the meteorological tables published in the Registrar-General's Returns of Births and Deaths, that the amount of rain which descended upon these days happened to be the average for the whole year. I think, therefore, that the Sewage examined by me, pretty closely resembles the average quality of the article throughout the year.

With respect to the amount of Sewage annually produced in Dublin, I have made the following calculations :—

The present supply of pipe water is about 9,500,000 gallons per day; the average daily rain-fall over the sewered districts is about 5,700,000 gallons. The amount of Sewage, therefore, which passes daily into the sewers is 15,200,000 gallons, or 67,857 tons 2 cwt. 3 qrs. 12 lbs., which at the rate of 14*s.* 5·92*d.* per 100 tons, would have a money value of £491 14*s.* 9·12*d.* From these data it will be found that the Sewage annually produced in Dublin amounts to 24,767,857 tons 3 cwts. 2 qrs. 12 lbs., the money value of which is £179,484 7*s.* 4·8*d.*

I am aware that many persons will consider this estimate of the money value of the Sewage of Dublin to be excessive; but I have simply placed the same value upon its various ingredients as I would do

if they entered into the composition of guano, or of other artificial manures. If 100 tons of this Sewage were gradually distributed over an acre of land, under any kind of crop, I believe that it would be good value for 14*s.*; but under ordinary circumstances so large a quantity of Sewage is applied per acre, that a large proportion of its soluble ingredients pass away from the soil. The greater part of the most valuable ingredient of the Sewage—namely, the nitrogen, is in the form of urea. This substance I proved by experiments performed in 1856 (and described in a Paper read before the British Association at their meeting held in this city the year following) to be capable of furnishing nitrogen to plants; but Liebig has since then shown that it passes readily out of the soil—a negative quality, which is a great drawback to its use as a manure. The soil possesses the remarkable property of removing from its solutions such substances as potash and phosphoric acid, which furnish food to plants. When Sewage water is poured over the land, the soil seizes upon and retains the ammonia, phosphoric acid and potash present in it, but allows the urea to pass through. This curious absorptive power of soils has, however, its limits; so that, if an excessive quantity of Sewage be poured over a field, some portion of it, and more especially its urea, will not be permanently retained by the soil. Owing to these circumstances, and to the fact that the Sewage flows at times that it is not required, the actual value of the drainage of this city will not correspond with the theoretical estimate which I have given. If, however, the Sewage be applied to an area of 8000 acres of grass land, its money value will be found to be not much short of £100,000 a year.

The value of the Sewage of a town may be ascertained by other means than the analysis of the article. By determining the actual value of the ejesta of an average unit of the population of a town, and by ascertaining the number of its inhabitants, a pretty close estimate of the value of its Sewage (provided, of course, that all the waste matters pass into drains) may be formed. Unfortunately, however, there are considerable differences of opinion as to the manurial value of the excrements of an individual, averaging all ages and both sexes. Dr. Hoffman and Mr. Witt estimate them at 10*s.* 10*d.* per annum, while Professor Anderson sets them down at 6*s.* Whilst agreeing with Professor Anderson as to the amounts of potash, phosphoric acid, and ammonia, yielded by a unit of the population, I differ from him as to the prices which should be placed on some of these ingredients. Dr. Anderson states that an adult male excretes daily the following quantities of valuable matters:—

Fertilizing Matters.	In Urine.	In Fæces.
	Grains.	Grains.
Nitrogen,	214	24
[Equal to ammonia,	260	29]
Phosphoric acid,	50	25
Potash,	45	5

This gives for the total annual production :—

	lbs.
Ammonia, ...	15
Phosphoric acid, ...	3·3
Potash, ...	0·3

"On these substances the value of the whole depends; for, though there are other constituents, their quantity is so small, and their manurial importance so trifling, that they may be left out of consideration. If the valuable matters be taken at the price at which they are sold in guano, then the annual value will be :—

	s.	d.
15 lbs. of ammonia, at 6*d*., ...	7	6
3·3 lb. of phosphoric acid, at 1½*d*., ...	0	5
3 lbs. of potash, at 2½*d*., ...	0	7½
Total value, ...	8	6½

"This estimate, it will be noticed, applies to the excretions of the adult healthy male. Those of the female are less valuable by a fifth; and of children the amount, and consequent value, depends upon their age. In fact, the quantity goes on gradually increasing to the period of maturity, and then again diminishes when the bodily functions become less active, towards the close of life. When the proper allowance is made for these (for which a rather elaborate calculation is required, into the details of which it is unnecessary to enter), it appears that the average value of the substances contained in the solid and liquid refuse for the whole population of both sexes and all ages is almost exactly two-thirds of that above given, or, in round numbers, 6*s*. per head."

From the above it will be seen that Dr. Anderson values ammonia at £56 per ton, and phosphoric acid at £18 per ton. I, however, value ammonia at £70 per ton, and the soluble phosphoric acid in Sewage at £40 per ton. The soluble phosphoric acid in superphosphate of lime and other artificial manures is valued by chemists at a higher rate than this. I also place a value upon the soda salts and the organic matters. Affixing, therefore, a higher value to some of the ingredients of excrements than Dr. Anderson does, I consider the amount annually produced by each individual to be worth 8*s*. In 1861 the population of Dublin within the municipal boundaries amounted to 254,808. A great number of persons residing in the suburbs, but employed during the day in the city, are not included in the census. There are sewers from a few suburban places which empty themselves into the Liffey. We may safely assume, then, that the Sewage of Dublin which flows into the Liffey contains the mixed excrements of 260,000 persons, worth, at 8*s*. per head, £104,000. This sum is, however, far short of the amount which I have already stated I consider the Sewage of Dublin to be worth; but the difference may partly be accounted for as follows:—In 1862 there were within the municipal boundaries 7365 horses, 78 mules, 572 asses, 762 heads of horned cattle (including 602 milch cows), 773 sheep, 7558 pigs, and 1589 goats; total, 18,697 animals. The census of these

animals was taken in summer, when the greater numbers of the horned stock belonging to the dairies were pastured in the rural districts. In winter the milch cows are more numerous in the city, and their liquid excrement no doubt improves the Sewage as a manure. The quantity of liquid excrement formed by a cow is at least seven times greater than that voided by a man; and it is almost needless to remark that the ejesta of a horse is much more valuable than that from a man. I am under the mark when I put down the average value of the manure produced from each of the animals above-mentioned at £1 per annum, or a total of £18,697, which, added to the value of the human effete matter, makes up the sum of £122,697. The soap suds, refuse parts of food, and slops of all kinds from private dwellings, the excrements of thousands of dogs, cats, and birds, and the waste matters from manufactories, which find their way into the sewers, must be worth a large sum as manure. We must also take into account the ammonia and nitric acid which are carried down from the atmosphere into the soil, and are found in the Sewage. Even the saline and organic matters contained in the pipe and drainage water, inconsiderable as their amount is when compared with the quantity of pure fluid, come to have no small value when millions of tons of water are dealt with. I venture to say that the potash, soda, and other fertilizing matters contained in 24,000,000 tons of river water, undefiled with sewage, would, if valued at the same rate as if they were constituents of artificial manures, be worth a large sum.

I have endeavoured to show that the estimate which I have made of the value of the Sewage of Dublin, as deduced from the results of my analysis of that fluid, is not very much higher than the estimate based upon the assumed value of the ejesta of the population, and other effete matters produced in towns. Any difference that may exist must be attributed to the difficulty of obtaining an average sample of the Sewage, rather than to the value of the excrements being overstated.

PROBABLE SPEEDY UTILIZATION OF THE SEWAGE OF LONDON AND DUBLIN.

That the public are at length awakened to the fact that they have at their very doors sources of manure rivalling in extent the guano islands of Peru, is evident from the eagerness which capitalists now evince to secure possession of the Sewage of London. One company proposes embarking the colossal capital of £6,200,787; and if granted the use of the whole Sewage of the metropolis, they believe that their undertaking would realize a profit of thirty per cent., a fair proportion of which would be paid over to the Board of Works. The persons who represent this company offer to prove the *bonâ fide* nature of their application by depositing the sum of £60,000 with the Board of Works, on the condition that it should be forfeited if the company fail to fulfil their engagements. Resolutions in favour of this company's scheme were passed during the last year at a great many of the parochial meetings. Another company proposes to convey the Sewage by

culvert and embankment to the Maplin Sands in Essex, a distance of forty-four miles. These Sands, it is proposed, should be reclaimed in the ordinary manner, and fertilized by the Sewage. The area to be reclaimed amounts to 12,000 acres, and the cost of the undertaking is set down at £2,000,000. This scheme, which appears to stand well with the Board of Works, deals only with the Sewage of North London. There are several other projects for utilizing the Sewage of London afloat, and there is no doubt but that before long some one of them will be adopted and carried out.

Dublin is more favourably situated with respect to the economic disposal of its Sewage than London. It is nearer the coast, where the land best adapted for Sewage operations is alone obtainable. I am decidedly opposed to the proposal so frequently made to lay down a system of pipes for the purpose of selling the Sewage to farmers. The price obtained for the Sewage, if indeed farmers could be persuaded to purchase the article, would not pay for the cost of its distribution. In fact, the use of Sewage can only yield very satisfactory returns when it is one of the means made use of in the formation of slob lands. At Lough Swilly several thousand acres have been reclaimed from the sea within a very recent period; and the operations have, wherever they were fully completed, realized a good profit. The rent of this slob land varies from 18*s.* to £2 per acre; but some of it is very poor, owing to the want of manure. This is the kind of land which would drink up enormous quantities of Sewage, and produce correspondingly large crops. I believe the company who propose to apply the Sewage of Dublin intend to effect the reclamation of about 2400 acres of sandy wastes, lying between the North Bull Wall and Sutton, and to convert them into dairy farms. I believe this project contains all the elements of success. The reclamation of this slob land would be a profitable speculation *per se;* but when every acre could, by the application of Sewage, be rendered equal in productiveness to ten acres of ordinary land, the operations must in a pecuniary point of view prove very remunerative.

The only advantage which Edinburgh possesses over this city is that its Sewage flows over the irrigated lands by the force of gravity alone. However, the cost of pumping the Sewage of this city up to a height sufficient to give a fall towards the North Bull would not be very great. The trials made with twenty-five Cornish steam-pumping engines in 1851 showed that, on the average, the combustion of one cwt. of coal would by means of these mechanisms raise 1,600,000 gallons of water a foot high. With these data, I calculate that the whole of the Dublin Sewage,* amounting annually to 24,767,857 tons, could be raised

* Since my Paper was read, I have learned from Messrs. Barrington and Jeffers that Mr. Hemans, the eminent engineer, has already made complete plans for the application of the Sewage. He proposes pumping the Sewage to a height of 18½ feet. There will be no reservoir, only a pumping well. The fall of the Sewage will be 2½ feet per mile to the pumping station, and from thence to the meadows three feet per mile. The floor of the main sewer at the pumping station will be 11½ feet below high-water mark at ordinary spring tides.

to the height of fifteen feet by the combustion of 2580 tons 12½ cwt. of coal, which, at 15*s.* per ton, would cost £1935 9*s.* 4½*d.* This would be only ten per cent. of the value of the Sewage, and would not add materially to the cost of the dressing of each acre. But here I would remark, that the quantity annually produced in Dublin is sufficient to manure at least 8000 acres.

EFFECT OF THE AGRICULTURAL APPLICATION OF THE DUBLIN SEWAGE UPON THE PUBLIC HEALTH.

Since the subject of utilizing the Sewage of towns has become a popular one, the question has arisen,—Will the application of Sewage on a large scale injuriously affect the health of the people who may happen to live near the sewaged lands? In the case of a portion of the sewaged meadows near Edinburgh, there is no doubt but that gases, vapours, and putrescent particles are occasionally given off, which are extremely unpleasant to the sense of smell, and certainly are injurious to health. At Lochend and Roseburn the odour, especially during very warm weather, is most offensive; and the winds that constantly blow from either of these places into the city are anything but "balmy breezes." These malarious exhalations arise, however, to a great extent from the open drains through which the Sewage flows. A large proportion of the effete matter produced in the "old town" passes into a stream termed, very characteristically, the "Foul Burn." This stream becomes an open sewer just beyond the eastern side of the town, and during the summer constantly evolves highly fetid gases and vapours. At Craigentinny, which is about two miles from the city, the Sewage is poured over grass land, which speedily drinks it up and completely deodorizes it. I have on three occasions during warm weather visited the sewaged meadows at Craigentinny, and I am enabled to affirm from actual observation that the odour from them is almost inappreciable.

The residents of Clontarf and Baldoyle no doubt feel alarmed at the probability of the Sewage of Dublin being brought close to their doors; but, if the thing be done properly, there will be no real ground for apprehension. The natural destination of the excrements of land animals is the earth, and not the water. If the Sewage of Dublin be brought by means of water-tight conduits to the seaside, and deposited in an absorbent soil, it will not give off miasma.

At present the fæcal matters produced in this city are thrown into the river and bay, in which they slowly decompose, evolving all the while pestiferous vapours. If deposited in the earth, these vapours would not be given off, but would furnish food to plants. No doubt, sewaged lands sometimes emit disagreeable vapours and gases; but that is only when their absorbent and deodorizing capabilities are too highly taxed. In the case of the Edinburgh meadows, from 10,000 to 15,000 tons of Sewage per acre are annually poured over them. Need we wonder, then, that some portion of this fluid remains on the surface to stagnate, and produce miasma! If the Dublin Sewage Utilization Com-

pany adopt the plan of moderate dressings—say 3000 tons per acre—I feel quite confident that the scene of their operations will be far less offensive to our olfactory nerves than the strands at Clontarf and Irishtown now are when the tide is out. In any case, the cost of deodorizing the Sewage before its application is not very great: M'Dougall's disinfecting fluid is capable of effecting this, at a cost of only a few pence per 100 tons.

With respect to the purification of the river and the bay, which would result from the application of our Sewage, I need but remark, that the insoluble ingredients in the latter amount annually to about 5000 tons of absolutely dry matter, corresponding to at least 40,000 tons of fetid mud, which at present, like waifs and strays, is tossed to and fro by the tides, discharging fever-breeding gases and vapours into the air.

I fear I have spun out this Paper to an inordinate length, but I trust that the importance of the subject will prove a fair excuse; and, thanking the Council of the Royal Dublin Society for permitting me to bring it under the notice of this meeting, I will conclude in the words of Liebig:—"If clearly understood, and properly managed, the employment of Sewage will prove a blessing to agriculture; and those who by unwearied perseverance have at last seen the consummation of their labours may justly be looked upon as the benefactors of their fellow-men."

NOTE.—The sanitary question arising out of the proposed application of the Sewage of Dublin has excited considerable discussion since the foregoing Paper was read before the Royal Dublin Society. Several very influential persons, connected by ties of property or residence with the districts near which it was proposed to utilize the Sewage of the city, energetically opposed the project. Several eminent medical men, too, expressed very strong opinions relative to the application of the city Sewage to the sands of Clontarf—maintaining that, if such a project were carried into effect, the public health, not only in Clontarf and Baldoyle, but even in Dublin, would seriously suffer thereby. All these opinions were founded upon vague generalities; upon such scientific platitudes as the poisonous nature of the gases given off from putrefying organic matter; and, finally, upon the alleged evil effects of the Sewage irrigation near Edinburgh. With respect to the effects of the Edinburgh Sewage, no conclusion of general application can be drawn from them, because the article is applied in such enormous quantities, that the soil is utterly unable to properly absorb and deodorize it—in fact, the thing is overdone. That, however, Sewage, when properly utilized, does not give off matters injurious to the public health, is evident from a letter which I have recently received from Dr. Sutherland, Medical Officer of Health for Croydon. In order to understand the full significance of Dr. Sutherland's statements, it will be necessary to bear in mind that

the estimated population of Croydon (parish) in 1864 amounted to 37,862; the number of houses is 5585, of which 4870 are in connexion with public sewers, the contents of which are used in irrigating 300 acres of grass land close to the town. Dr. Sutherland states:—"I think I can answer your second query with great confidence, that the public health has in no way been injured by the Sewage irrigation." It is the opinion of all persons here who have paid any attention to the subject, that the irrigation has been very successful in an agricultural point of view, and I can speak most favourably of it as a sanitary measure."

The Bill for Utilizing the Sewage of Dublin, having met with great and unexpected opposition on the part of certain residents at Clontarf and Baldoyle, has been withdrawn for this session of Parliament. I understand, however, that, with some modifications relative to the *locale* of the Sewage irrigation, the Bill will be reintroduced next session, and with every chance of success. The scheme for utilizing the Sewage of London, proposd by Messrs. Hope and Napier, has been approved of by a Select Committee of the House of Lords. This scheme is in principle identical with that brought forward in Dublin by Messrs. Barrington and Jeffers; and, in my opinion, proposes the most feasible and economic means for the useful disposal of large quantities of Sewage.

MR. JAMES HAUGHTON, in the course of some observations, said the question as to Dublin was not so much as to the gathering up of the Sewage, as whether they could secure the condition of giving it to the farmers and others at prices that would enable them to produce the good results from it that had been produced elsewhere. As to the mechanical mode of doing this, Mr. Jeffers might perhaps give them some information. He considered that the large mixture of water with the Sewage was an inevitable circumstance, and that they should now deal with Sewage mixed with water, and make as much of it as they could. He had learned many facts from Mr. George Woods Maunsell, who had personal experience of the matter, with regard to the great results obtained in Edinburgh from the utilization of the Sewage, and the statements laid before the meeting that evening were not at all exaggerated. There were frequently four crops of meadowing in the year taken off those lands. He also referred to the plan proposed in letters, signed "Dixie," in the "Irish Times." The writer had suggested that sewers should be constructed by walls built under the present walls of the River Liffey. But excellent as that project might be in other respects, it was rendered nugatory, in his opinion, by the fact that the channel of the River Liffey was already too narrow, and that there was barely room to turn the steamers.

MR. JEFFERS, of the firm of Barrington and Jeffers, solicitors to the Bill for the Utilization of the Sewage of Dublin, said it was too late that evening to go into the various points raised by the Paper. He read from the evidence of witnesses examined before the Sewage Commission. Lord Essex, who utilizes the Sewage of the town near which he resides in his own demesne, stated in his evidence that in the momentary application of the Sewage to the ground an offensive smell could be experienced, which could be obviated by holding the distributor near the ground; but when the matter was in the ground there was not the slightest smell whatever, and the men who used it never suffered from it. He alluded to this particular point, because he understood that certain parties at Clontarf and Dollymount were afraid that it would injure their house property; that, in fact, they supposed that the odour which was occasionally experienced from the Liffey would be transferred to the green lanes of Clontarf. But no such apprehension need exist. Mr. Way, late chemist to the Agricultural Society of Great Britain, who was examined

before the Sewage Committee in 1852, and again last summer, stated that it was in the power of soils to absorb manures, and that "land possesses the power of deodorizing sewage." Dr. Frankland, in reference to the question of the offensiveness of Sewage when applied to land, states that he found the odour disappeared almost immediately after its application; that it was only where it was kept stagnant it became offensive, and that deodorization before applying it to the land was not necessary. He (Mr. Jeffers) hoped that they would be able to succeed in effecting such a very desirable project as the utilization of their city Sewage; and he was anxious that they should succeed in doing so as much for the benefit of the citizens as to show that they were not incapable of inaugurating or carrying out successfully an Irish industrial project.

COLONEL WALSHE said that at certain stages of the tide there was an offensive odour in the direction of Clontarf, and he did not see how that was to be remedied by the proposed works.

MR. JEFFERS said it had been proved in the evidence from which he had given extracts, that no offensive smell arose from liquid manure being applied to a sandy soil, such as that at Dollymount and Clontarf.

MR. CARROLL said he had had experience in every part of Ireland of the value of liquid manure upon land, and he had no doubt of the success which would attend the proposed undertaking.

MR. JOHN R. GARSTIN wished to know from Mr. Jeffers what the expense per acre would be of raising the manure to the requisite height for the purpose of applying it to the lands. Dr. Cameron had told them it would be about £1 per acre for fifteen feet.

MR. JEFFERS said it was purely an engineering question. The calculations necessary to inform them on that point were such as to preclude the possibility of his going into the subject at that hour of the evening. He might, however, state that they had engaged the services of Mr. Hemans, who had been engaged in the work of utilizing the Sewage of London, and he was of opinion that there was not the least practical difficulty in the matter.

THE CHAIRMAN said that the public at large should feel much indebted to Professor Cameron for his able and interesting Paper on a subject which now engaged the attention of the second city of the empire, and caused great commotion in the capital of the United Kingdom. No question of the present day gave rise to a greater struggle than the utilization of the sewers of London. There was no difference of opinion that the sanitary condition of a city was to be considered, in preference to those hypothetical ideas as to the value of the Sewage. Chemists made out that there was a certain amount of value in Sewage, and he did not say that was incorrect; but when they found that there was a mixture of water in various proportions, it became a very serious question how they were to get the amount of money which Professor Cameron mentioned. Professor Way, who had been mentioned by Professor Cameron in his Paper, complained before the committee of the use that had been made of his analysis; for it appeared that other chemists took his analyses, and placed their own value on the materials which he obtained. He reprobated that, and took the opportunity of publicly withdrawing these analyses, because he said it was impossible to take any particular sewer. He mentioned that circumstance to show the great difficulty there existed in fixing a value on Sewage. He thought it was quite right that the ratepayers should certainly get the profits of the Sewage; but it should be considered that a very large expenditure must be gone to by somebody in order to make it profitable, and therefore a certain allowance should be made to the parties undergoing that outlay of money. The quantity of grass stated by Professor Cameron to have been raised at Edinburgh by means of Sewage manure was by no means exaggerated. It was enormous. The thing, in fact, was overdone there. The Sewage of that city, containing 180,000 inhabitants, was applied to about 3000 acres of land, and the fact was that the drains through which the stuff flowed were the most abominable things imaginable. Now, the population of Croydon, to which reference has also been made, was but some ten or twelve thousand, and the Sewage of that

town was applied to as large an extent of land as that at Edinburgh. There (at Croydon) the application of the Sewage was the most perfect thing that one could possibly conceive. Sewage water in its usual state was black and dirty stuff; but as it is discharged into the neighbouring river at Croydon, it was perfectly clear and pure, and could not be distinguished from spring water. This showed what was capable of being effected by a proper application, in proper proportion, of Sewage to land. He had himself walked over the land thus fertilized at Croydon in company with the engineer of the town, who had kindly explained the whole matter to him, and he did not experience the slightest bad smell. With regard to Manchester, Professor Cameron had put the matter in a very proper light. The cesspool system was maintained there still, and the corporation were obliged to clean the cesspools at great expense. With regard to Rugby, the results of the experiments there, as quoted by the Professor from the Report of the Parliamentary Commissioners, was very extraordinary, and it showed the effect of Sewage upon land. There was no doubt about its producing the results stated. There was great difference of opinion, however, as to the mode in which the application should be conducted. Some parties alleged that it was better to apply the Sewage in streams over the land by means of a jet and hose; but the fact was, the cost of such a process would be so great as to put that entirely out of question. At Milan, also, enormous quantities of Sewage were applied to the land with great results. With regard to the strength of the Sewage of Dublin Professor Cameron had alluded to analyses which he had made, and which he (the Chairman), had no doubt, were quite correct; but he was afraid that to come to anything near the truth the samples for analysis should be taken continuously every hour for a long period of time. Though what Professor Cameron said was true—namely, that the Sewage which he took happened to be when there was an average rain-fall there might have been a heavy land-storm two or three days before, which might have cleared all the good stuff out of the sewers, and he might have got a weaker solution than at another time.

Professor Cameron observed that the samples he had analyzed were taken on three consecutive days, and that the really valuable ingredients of Sewage do not remain in the sewers, but rapidly flowed out.

The Chairman said that in his opinion the samples should be taken out of those sewers at least every two hours for a month or six weeks running. It would be a work of very great labour, but it would be necessary in order to come to any definite conclusion upon the subject. On account of the different elements that entered into the Sewage, it would be a very difficult question indeed to ascertain the exact strength by testing samples taken for a short time. He had already stated that where the Sewage was properly used, as at Croydon, there was no smell whatever. As to the colour of the grass it was also of great importance in improving it, on account of the water running with it over the land. He did not agree with Professor Cameron in thinking Dublin better adapted for the utilization of Sewage than London, because Dublin was situated on the sea, whereas London was not, and there was a larger fall at London.

Professor Cameron.—There is a dead level of several miles in the proposed forty-four miles' drain from London to the Maplin Sands.

The Chairman proceeded to say that Professor Cameron had also remarked that he calculated an expenditure of £2000 a year on coals for combustion as sufficient to accomplish the raising of the Sewage to a height of fifteen feet; but the fact was, that to raise it to a height of fifteen feet would be to raise it to high water mark and no higher, and the pumping of it away altogether would increase the expenditure very much. As for the observation of Colonel Walsh, that a strong smell arose from Clontarf sands, he believed that that arose from the decomposition of seaweed, and not from Sewage.

The meeting then separated.

XXXI.—*On the Construction of the Atlantic Cable.* By MR. HARRY N. DRAPER.

[Read February 28, 1865.]

HAVING by the kindness of Mr. Chatterton, Engineer to the Gutta Percha Company, obtained specimens illustrating the construction of the New Atlantic Telegraph Cable, I have taken the opportunity of bringing them before the notice of the Society.

I am not about to occupy the time of the Society by any detailed paper on the subject, but would, in placing the specimens before you, just call attention to the leading features of the new Cable, and the particulars in which it differs from that which was first constructed.

The conductor in the new Cable consists of seven copper wires (six wires twisted round a central wire), which, for the purpose of obtaining solidity, is covered with a layer of the mixture known as Chatterton's Compound—consisting I believe of Gutta Percha, India Rubber, and coal-tar. The weight of this compound wire or strand is 300 lbs. per nautical mile. The gauge of the single wires is what is technically known as No. 18; that of the entire strand, No. 10.

The insulation is effected by four layers of Gutta Percha, laid on alternately with four thin layers of Chatterton's Compound. The weight of this insulation is 400 lbs. per mile.

The insulated conductor is externally protected by ten iron wires of No. 13 gauge, each of which is covered with five strands of Manilla yarn, saturated with preservative compound, and the whole laid spirally round the core, which has first been padded with hemp, also saturated with the preservative mixture.

The weight of the entire cable in *air* is 35 cwt. 3 qrs. per nautical mile.

Its weight in *water* is 14 cwt. per mile.

Its *Breaking Strain* is 7 tons 15 cwt. It will therefore bear its own weight in eleven miles of water.

The deepest water to be encountered is somewhat less than $2\frac{1}{2}$ miles.

The Cable has, therefore, more than $4\frac{1}{2}$ times the strength necessary for the deepest water to be encountered.

It may not be uninteresting to put in contrast the details of the structure of the old Cable.

In this, also, there were seven wires united into a strand, the weight of which was 107 lbs. per mile. The insulation consisted of three coatings of Gutta Percha, weighing collectively 261 lbs. per mile. The external protection was obtained by eighteen strands, of seven iron wires in each, laid round the hemp-padded core. The gauge of each of these wires was $22\frac{1}{2}$.

The weight of the entire cable was, in *air*, 20 cwt. per mile; in *water*, nearly $13\frac{1}{2}$ cwt. It would therefore bear its own weight in a little less than five miles of water.

Its *Breaking Strain* was 3½ tons, and it had but little more than twice the strength requisite for the deepest water to be encountered.

You will, however, see much more readily, by actual comparison of the two Cables, the superiority of the new one, which appears indeed to possess all the elements of success. It has a greater conducting power, twice the strength, and half the specific gravity of the old Cable, and approaches indeed more nearly to the simple insulated and hemp-covered conductor which Captain Maury believes to be far preferable to the heavy and cumbrous cables, in which the iron wire sheathing conduces only to offer resistance to the impetuosity of the waves and ocean currents. "The tiny Nautilus," says Maury, "rides out the hurricane, and weathers storms in which the stoutest men of war have foundered;" and in order to make progress in submarine telegraphy, we must proceed upon the principle, that "a slack line in the sea will hold longer than a taut cable."

XXXII.—*On Arctic Discovery.* By JOHN LOCKE, A. B., &c.

[Read March 20, 1865.]

CAPTAIN SHERARD OSBORN has suggested the project of another expedition to reach the North Pole by Smith's Sound; and Dr. Petermann, of Gotha, a veteran author on this frequently-discussed topic (having published at different times fifteen treatises on polar discovery), has addressed two letters to Sir Roderick Murchison, President of the Royal Geographical Society, advocating in preference the route by Spitzbergen, and asserting that the sea is open in winter by this course to the Arctic Pole. These communications have been sent in lithograph to a few correspondents; the first Paper on Arctic Discovery has been already discussed at a meeting of the Geographical Society; the second, reviewing the comparative progress of Antarctic research, has not yet been made public; but I may observe, that the subject was brought before this Society in November, 1860, in a Paper communicated by me on Maury's curious theory of the existence of a habitable and temperate region enclosed within the icy cincture of the Antarctic zone.

In reading the adventurous expeditions of the voyagers and whalers of the sixteenth and seventeenth centuries, in their small and ill-found vessels, sometimes not exceeding fifty or sixty tons, one is inclined to believe that the Arctic polar space has been repeatedly sailed over by these enterprising navigators. But, to come to the present century, we find the remarkable fact of a Polynia, or permanently open Arctic sea, clearly established by the researches of English, American, and Russian explorers. Parry, in 1827, starting from the northern shore of Spitzbergen, by sledge and boat, reached the latitude of 82° 40′, in view of an ocean entirely free from ice, and which would have stopped his advance, even if the floes had not been drifting southward more rapidly than his sledge travelled in the direction of the Pole. Again, Kane, in

his sledge expedition along the western shore of Greenland, asserts that he reached in latitude 82° an open sea of a temperature of 36°, with innumerable birds and seals sporting on its surface; and Wrangell, in his sledge journeys from sundry points on the coasts of Siberia and of the Lachow Islands, invariably reached an ocean entirely free from ice at from thirty to forty miles from land:—"We beheld (he says) the wide immeasurable ocean spread before our gaze; a fearful and magnificent, but to us a melancholy spectacle." Melancholy, because that very ocean was an insuperable obstacle, as in Parry's case, to his advance northward by sledge. There is a vast fund of information on Arctic exploration by Russian enterprise accessible only to the few who are acquainted with the Russian language. Wrangell's narrative has become known to English readers through Mrs. Sabine's translation from the German edition; and a joint enterprise, organized by England and Russia, might prove the most likely to accomplish results conducive alike to the progress of commerce and science. It would assuredly be wiser for both Powers to shake hands within the Polar circle (cold comfort!) than to meet in arms upon the sweltering sands of Central Asia (hot work!) Now, in this view of the question, and admitting Petermann's suggestion of the Spitzbergen route, I venture to submit that that island itself, and not a distant British seaport, should be made the starting point for the proposed expedition, despatching from England for the required purpose an iron steamer of light draught, together with all the materiel of residence and comforts, which the commercial resources and mechanical appliances of England can so efficiently supply. Government support is not likely to be again conceded to Polar enterprises, except perhaps in the form of a small subsidy, or loan; but if a trading settlement in the Spitzbergen Archipelago is demonstrated to be feasible and lucrative, science will follow, as elsewhere throughout the world, in the wake of commerce. And what are the facilities and encouragements offered in this remote region to the trader and occasional settler? The largest of the islands is about the size of Ireland; the Gulf Stream there reaches its northern limit, and loses itself within the intricacies of the Archipelago, which is manifestly the cause of the Spitzbergen winter being milder than the winter temperature of Nova Zembla, and parts of inhabited Greenland, North America, and even Siberia, all situate in more southern latitudes. Professor Scott will exhibit Dove's maps, illustrating this curious fact by the isothermal curves. Again, the ocean temperature off the Spitzbergen coast, as tested by the deep-sea thermometers, is but one degree colder than at the same depths in the Carribean Sea, the heavier and colder current returning southward along eastern, or "lost Greenland," as it is expressively termed; for that region possessed many colonies of Norwegian and Icelandic refugees and adventurers, who had settled there so early as the ninth and tenth centuries, but of whom now scarcely a trace exists, except the ruins of their habitations, which seem to have been overwhelmed by inundations from the bursting of glaciers. The Gulf Stream must have at a former period flowed along this coast; for Hudson, in 1607,

writes:—"We ran along near the shore, and found no great cold, which made us think that if we had been on shore the place is temperate." But since Hudson's visit East Greenland has been shut out from the navigator by fixed ice floes of hundred of miles in extent; and our chief knowledge of "lost Greenland"* is now derived from the land expeditions of a few travellers, especially of the Danish explorer, Sir Charles L. Giésecké, who was Professor of Mineralogy to the Royal Dublin Society some forty years ago, and communicated a Paper to the Royal Irish Academy on the subject in 1824. A complete history of his Greenland researches is extant in manuscript in the University Library at Copenhagen, and which Mr. Scott, our acting Professor of Mineralogy, expects to obtain and translate into English. Giésecké's curious and valuable collection of Greenland minerals in our Museum have been accurately classified and arranged by the Rev. Professor Haughton, and are supposed to be analogous to the characteristic mineralogy of the Spitzbergen Islands,† in which are found various ores, and, what is even more important for the settler and trader, beds of bituminous coal. Drift-wood also is borne to the shores in great quantity by the Gulf Stream; and the wood hills (described by Wrangell in Kotelnoi) consisting of interstratified sandstone and trunks of resinous trees, are stated to be found. However, even if delay occurred in procuring sufficient fuel on the first organization of a settlement, the marine and mineral oils (the latter of which are gradually coming into economic use both for heat and light, and motive power on sea and land) would amply and cheaply suffice for the brief interval. Fossil ivory is not so plentiful in Spitzbergen as in Northern Siberia and the Lachow Islands, where in many spots the soil is actually composed of masses of bones of the Mammoth and other extinct Mammals, bound together by frozen silt and mould. These immense deposits of fossil *reliquiæ* in certain detached localities is one of the strangest of geological puzzles. It is exemplified even in Ireland by the great number of skeletons of the *Cervus megaceros* found in particular spots in bogs, or in the lacustrine marl. Dr. Carte, in a Paper read before the late meeting of the Geological Society of Dublin, states that in one circumscribed spot of little more than half a mile in length on the River Commogue, in the county of Limerick, horns and other portions of forty skeletons have been dug out within the last few years; and the peasantry, who sound the marshy soil for these with long iron rods, the bone or palmated horn returning a dull and peculiar sound, expect to exhume many more antlers and bones in the same locality.

* There are dim Scandinavian traditions of the existence of a circumpolar Arctic land, still inhabited by a lost people, severed from the rest of the world, although no traces of any similar tradition have been noted among the natives of the southern hemisphere; yet, if Maury's ingenious meteorological inferences are ever found capable of verification, the inter-antarctic spaces would be more likely to attract the refugee or castaway to abide within their comparatively milder temperature.

† The precious garnet is the only gem observed in the Spitzbergen islands; but the mineralogy and geology are as yet little known.

But—to return from this digression—the first principal resources of Spitzbergen trade would probably consist in Narwhal ivory, the marine oils, and the peltry trade. The Arctic Bear and White Fox are numerous, also the Reindeer, which remain throughout the year, the vast distance from other lands, either insular or continental, and the intervention of seas never completely bridged by ice, preventing migration. The waters teem with fish, and with the Cetacea and Seal tribes. —— Parry found the vegetation rich and plentiful in Hecla's Cove and other localities; and, besides the nutritive mosses and other crytpogamous plants both of land and sea, ninety-three phanerogamous species were observed.

Among the multitudinous varieties of birds, the Northern Grouse (*Lagopus hyperboreus*) the Ring Plover, Auks, Guillemots, Puffins, the graceful Eider Duck, and Bernacle Goose, with others of their kindred tribes abound. Richardson's Skua sweeps with ample wing through the snow storm; and the notes of the beautiful Snow Bunting (*Emberiza nivalis*), the only song-bird of Spitzbergen, enliven the dreariness of the misty ravines and frozen plains. Several of these species furnish large resources of agreeable and wholesome food, easy of preservation for any length of time in that climate; and the uncommon beauty, graceful movements, and varied habits of the innumerable seafowl, give to these inhospitable solitudes a cheerful life, and continual opportunities of observation and amusement, which the Arctic traveller only can understand and appreciate.

These few remarks, I trust, are sufficient to prove the feasibility of a permanent settlement on these islands, even within the Arctic circle, and to prove that a continued residence is consistent with the preservation of life and health: a confirmatory fact adduced by Petermann in a former treatise may be added—that Mr. Crowe, then British Consul at Hammerfest, testified that a Russian, named Gharastin, had resided in Spitzbergen for fifteen consecutive years. The Russian hunters also, who sometimes remain during the winter months, describe the weather as milder than in parts of the Siberian mainland.

In adverting to the plentiful supply of carbonaceous food, so necessary to support the fire of life in regions of extreme cold, Professor Owen conjectures that the Manatee may be found in the Spitzbergen waters, and identifies this strange creature, the most like man in appearance and functions of all marine animals, with the mermaid of Norwegian story; but I venture to think that another of the herbivorous Cetacea, the *Rytina stelleri*, which has been totally exterminated by the voracity of the whalers and Esquimaux in Behring's Straits, is much more likely to be met with than the Manatee, a creature hitherto found only in tropical waters. The flesh of both animals is described as tender, and of a delicious flavour, like pork or veal.

Some members present may remember a Captain Semmes about thirty years since, of whom Alexander V. Humboldt makes a sad complaint (recorded in the "Kosmos," vol. i., p. 161), that he worried him and Sir Humphrey Davy to join in undertaking a subterranean expedition to the centre of the earth, maintaining that in or about lat. 82 deg.

there was an enormous opening, from which issued the Auroral lights, and through which a descent into the hollow sphere could be easily accomplished. It is not intended to insinuate that scientific gentlemen of our day entertain such extravagant ideas, though they will naturally be enthusiastic, each in his special department, in the anticipation of curious discoveries in a region hitherto unexplored by man.* Mere scientific researches, however, will not induce a great mercantile people to risk further loss of life and treasure. In England commerce has been from the earliest period of maritime discovery the pioneer of knowledge; and I repeat, that the most practical method of insuring success is the establishment of a trading settlement within the limit of the Arctic circle itself. If such a settlement be found practicable, and consistent with the sustentation of life and health, and if the fact is satisfactorily confirmed of an iceless and open Arctic Ocean, of comparatively mild temperature throughout the year, Spitzbergen appears to offer a suitable starting point and secure platform to plant the lever of discovery, in endeavouring to reach the North Pole.

XXXIII.—*Dr. Edmunds' System of Ventilation, for the Purpose of Improving the Sanitary Condition of Ships, and Preserving them from Decay; with Suggestions as to its Applicability for the Purpose of Ventilating crowded Dwelling-houses.* By Dr. J. M. BARRY, L. R. C. P. D., L. R. C. S. I., M. R. D. S., M. R. Z. S., &c., &c.

[Read April 24, 1865.]

MY object in bringing Dr. Edmunds' system of Ventilation under the notice of this Society is, first, because I have experienced its utility in preserving life and promoting health on board the ships of Her Majesty's Emigration Commissioners; and, secondly, because I believe, with very little alteration, the apparatus can be adapted to ventilating the crowded dwellings of the poor, the ill-ventilated rooms inhabited by whom do not materially differ from the confined space allotted to emigrants on board ships during their transit across the pathless deep. With respect to the necessity existing for a better system of Ventilation on board ships than any hitherto devised, we have only to refer to the frightful mortality in crowded passenger ships, arising from typhus, cholera, and dysentery.

In the ships of Her Majesty's Commissioners, in whose service I hold the office of Superintendent, the average mortality during the most unfavourable seasons never exceeded two per cent.

Last year the system of Ventilation I am about bringing under your notice was introduced into the service.

Some of the ships have accomplished the passage without the loss

* It is curious, that in Spitzbergen the mean declination of the needle from the geographical meridian has not undergone any sensible variation for the last one hundred years.

of a life, many of them being altogether free from fever, dysentery, or diarrhœa, the principal sources of mortality at sea. Another satisfactory result is the reduction of infantile mortality.

In some Australian passenger ships I could mention, one-third of the children under five years have died. In the Commissioners' ships fitted with Dr. Edmunds' apparatus, worked by a steam jet, the results have been truly gratifying, some of the vessels—"The General Caulfield," for instance—not losing any children. The system has been introduced into the Royal Navy; and while the mortality in the mercantile marine is three times greater than in the Navy, the mortality in Her Majesty's ships fitted with Dr. Edmunds' system is much less, while the diminished sick list amply testifies to the better sanitary condition of the sailor's dwelling.

To illustrate the necessity that exists for improving Ventilation in ships, and to preserve them from premature decay, I may refer to the observations of eminent writers on ship-building. Murray remarks that the means at our command for the purpose of preserving timber from premature decay may be summed up in two words—Seasoning and Ventilation—thorough drying of the timber on shore, when practicable; but by all means good Ventilation on board. If these well-known and universally approved principles were properly carried out, we should hear but little of rotten gunboats, or hasty repairs to frigates after a first commission. What is most urgently required is, that there shall be as little stagnation of air as possible. However well seasoned and dry the timber may be when a vessel is launched, it will rapidly absorb moisture from the damp atmosphere of the hold, unless evaporation from its surface be kept up by a forced circulation of air. The beneficial effects of Dr. Hales' system of Ventilation were evidenced by the fact that from 1753, when it was first employed in the old "Prince," to 1798, when the use of it was discontinued, the durableness of ships was materially improved, as well as the health of the crews of those ships to which it was applied, especially transports.

The Earl of Halifax, in a letter to Doctor Hales, stated that the mortality of the ships on the coast of Nova Scotia which were not ventilated was, in comparison with those which were, as twelve to one. Doctor Hales proposed to keep up a circulation of air with windmills and air-pumps. Mr. Parkins followed his system, substituting fans.

But what is most urgently required has not yet been practically realized—the producing a constant disturbing force on the lower part of the hold, which should give motion to the foul air that has a natural tendency to lodge there, while suitable means are, at the same time, in operation for carrying it off, and supplying its place by the introduction of pure air. The constant operation of some means to produce this effect is necessary for the preservation of ships, the health of the crew, and the ship's stores.

The introduction of pure and dry air into the hold is requisite to carry off the humid particles which adhere to the interior of a ship, and excite the latent elements of decay, which, under circumstances favourable to their development, are soon apparent.

Fincham, in his "Outlines of Ship-Building," remarks that it is in the hold of a ship, more than in any other part, that the destructive agents accumulate—moisture and impure air, arising from the decomposition of animal and vegetable substances which fall into the hold, or accumulate from the defective manner of stowing ships. The want of proper ventilation will produce the most serious results to the health of the crew and the condition of the ship.

To accomplish what is desired, a system of Ventilation is needed which will ensure a pure atmosphere in every part of the hold, and between the decks. In order to prevent the destructive effects of air-heat and moisture, and to produce thorough Ventilation, some disturbing force should be employed. It being thus evident that persons best qualified to form an opinion on the subject conceive that an efficient system of ship Ventilation is necessary for the preservation of ships from decay by dry rot, and as a means for preserving the health and promoting the comfort of passengers and crews; for as damp and insufficient Ventilation cause the destruction of the ship, so they prove equally injurious to the health of her occupants; and if an effectual remedy can be found for dry rot by removing its causes, by the same means will the ship also be rendered healthy. The inventor of the system of Ventilation which I now submit for your consideration has, I think, accomplished what has been so long required.

Doctor Edmunds, Staff-Surgeon in the Royal Navy, has had his attention strongly directed towards the subject of Ventilation by painful experience of disease and discomfort arising from the inefficient and uncertain measures usually adopted to lessen the stagnation of air in the close and confined decks of vessels of war. The construction of a ship, which is often considered to oppose so many obstacles to free Ventilation, in Doctor Edmunds' opinion, in reality offers facilities which are now for the first time made available by his invention. The important object is attained by means of a novel system of air shafts and channels, through means of which the perfect Ventilation of the ship's timbers and of the inhabited decks and cabins is secured. It is well known that dry rot, or decay misnamed dry rot, is caused by dampness of the timber surfaces forming principally the sides of the openings or timber spaces, which are close channels leading up from the bilges at the bottom of the hold; these have a vent in the between-decks; and it is for the purpose of their ventilation, to prevent decay or dry rot in the timbers, that they are left open; otherwise, but for so important an object, such a source of foul smells, malaria, and consequent disease, would never have been allowed so long to pollute and poison the air of a confined space in which so many have to live and breathe.

It would be a parallel case if persons on shore inhabited a crowded apartment, into which the foul air from a damp underground cellar, with drains running through, had vent by numerous open channels; but the passive circulation which takes place is insufficient for the purpose intended. The openings are usually in a damp state; and any timber employed in the ship's framework, if not well seasoned, is sure to decay. The premature decay of the gunboats hastily built during

the Russian War is conclusive evidence of this. By the first part of the new system the operation of these openings or channels is reversed; they are converted from their present action of fouling the air into most effectual means for purifying it. This is effected by making them all branch air channels of one large airshaft on each side of the ship, which being led into the funnel in steamers, or into hollow iron masts or tube and cowl ventilators in sailing vessels, a constant updraught is created through them up from the bilges and hold, and down from the mess deck, to the shaft, carrying all their foul contents into the open air, preventing contamination from the bilges and hold by creating a constant current of air flowing through the timber spaces. The timbers will be effectually ventilated, and dry rot prevented. Probably, even if the ship were built of unseasoned timber, all endemic causes of disease existing in the ship, and which occasionally cause, or at least promote, the ravages of fevers in tropical climates, will be removed by this plan. In most cases of malignant fevers occurring on board ships in the Royal Navy, the bilges and timber spaces have been found choked with decaying matter; and there can be no doubt that in the mercantile marine similar causes prevail, with leakage from cargo superadded.

In the Reports of the Social Science Association, it is stated that, notwithstanding the great advantages of selection, diet, and discipline enjoyed by the Royal Navy, the rate of mortality is much above the civil population; whereas, from the healthful life led by sailors, being removed to a great extent from many causes of disease, we might fairly expect them to enjoy better health. To complete the Ventilation of the decks, channels are provided. These are nothing more than the substitution of a strongly constructed air channel, in place of one or more of the planks forming the ceiling on each side of the deck to be ventilated. These planks vary in thickness from three to five inches, in a channel of the same depth, and from eight to twelve inches in width, in proportion to the size of the ship, and can be constructed so that the iron plate completing the channel above may also act as a stringer plate, greatly increasing the longitudinal strength of the ship. It occupies no apparent space, and is in the best possible position for ventilating the decks, as it acts immediately upon the air between the beams where all the foul, heated, and rarified air collects. The deck channels are ventilated similarly, with openings into the main shaft. Together they form a perfect system of Ventilation in steam ships, as nearly as possible self-acting, available where Ventilation is most needed, and causing no draught, as the action is diffused by communicating cross channels, two sides of each being formed by a portion of the cross beam and the deck, completed by a thin wooden batten perforated with holes. It will be seen that this system promotes natural Ventilation, through aiding the escape of foul air, and providing outlets in the most convenient places for it. The funnel draught is most powerful at all times, but particularly when steam is up. Hollow iron masts, forming three outlets for discharge, are equally effectual in steam or sailing vessels, as they have a constant powerful updraught. Tube and cowl ventilators in connexion with these shafts are available in sailing ships, with the

advantage of being used either as uptakes, or, when a fresh dry wind is blowing, the cowl may be faced to the wind, when a stream of pure air will be forced through the ship. By either mode the deck atmosphere will be rendered pure. But, as a rule, Ventilation by exhaustion is to be preferred. Pure air will naturally take the place of the foul, admitted through hatchways, ports, and scuttles. Other means of Ventilation are also available in connexion with this system of shafts, such as a steam jet, fans worked by hand, or a fire draught otherwise applied. With this plan of Ventilation, the practice of stuffing the timber spaces with tons of salt, or other protecting substances against dry rot, is totally unnecessary. The existence of foul air in the hold, damaging cargo, as well as causing disease and discomfort, is impossible. The shafts and channels are of easy construction, and, once established, are always available.

Doctor Edmunds' system has already been introduced, by order of the Lords Commissioners of the Admiralty, on board Her Majesty's ship "Royal Sovereign;" the "Zealous," iron-cased frigate; and the "Favourite." Although under great disadvantages as regards Ventilation, necessarily attendant upon their construction, and not having side ports or scuttles, still they will be undoubtedly the best and most healthfully ventilated ships ever built. With respect to the application of his system of Ventilation to emigrant ships, I have received from Doctor Edmunds the following observations:—"Of all classes of ships in which Ventilation requires the most careful consideration, emigrant vessels occupy the first place. In them we have large numbers of helpless men, women, and children, mostly for the first time in their lives crowded together in the narrow decks of a ship; unused to the motion of a vessel, they become physically prostrate, and mentally depressed; and, but for the excellent rules of Her Majesty's Emigration Service, carried out under the direction of experienced medical officers, their condition would soon become most deplorable. But even under present advantages it has been found impossible to effect perfect Ventilation of those crowded decks. Effluvia from the hold still further contaminate the air already vitiated to a great extent, particularly in calms and in bad weather, when it is necessary to close the hatches more or less. It is at these times that the foul air from the holds and bilges becomes most apparent and injurious, collecting chiefly in the highest part of the deck. It is only under exceptional circumstances that the carbonic acid evolved by the lungs or generated by vegetable decay escapes."

Most of the endeavours to ventilate ships have been directed to supply fresh air chiefly by windsails, but they are too uncertain; and in calms, when most needed, are valueless. Those only who have been becalmed in an emigrant ship on the Equator can fully comprehend the stagnation of air which prevails, particularly during the prevalence of heavy rains, which compel the passengers to remain below. The introduction of air in the ordinary way cannot be always accomplished without creating an amount of damp and discomfort, especially to those berthed in the vicinity of the windsails; and nothing is more common than to

find the mouths tied up, passengers preferring the close and vitiated atmosphere to a cold damp draught from the windsail. When we remember that the apertures in the ship's lining are at the same time discharging the foul air from the hold, we can understand the utility of enclosing those openings in the longitudinal tube connected with the perpendicular air shaft, which conducts the objectionable air into the atmosphere. As the heated and vitiated air escapes through the cowl-headed ventilator, cool and pure air occupies its place in the hold and between decks, so long as there is any wind. During calms it is necessary to have some supplemental means of keeping up a circulation of air throughout the ship: a steam jet here becomes a valuable and powerful auxiliary, always available when the aërial current fails us.

The steam jet is directed into the shaft, and escapes through the cowl ventilator, which when steam is used must be turned from the wind; it should be placed near the centre of the ship, and for a vessel of 1000 tons ought to be two feet in diameter. Through this every up-current of one foot per second velocity will discharge 10,800 cubic feet per hour of foul air—with a breeze blowing, the velocity will be about ten feet per second; this is amply sufficient to renew thoroughly the vital air in every part of the structure, without creating the least perceptible draught. During the day the air is drawn equally from the passenger deck, hold, and bilges, but at night almost exclusively from the passenger deck, the hatches communicating with the hold being then closed. The respiration of an individual during one hour is estimated at about ten cubic feet, the quantity mentioned as carried off; and an equal quantity of fresh external air introduced is at the rate of 400 cubic feet per hour for each of 250 individuals. The source of the steam jet in vessels propelled by sails is the condenser. The difficulty of stowing sufficient water in a ship for a long voyage has led to the use of distilled water, which is found, when properly aërated, to be perfectly sweet and wholesome; therefore a distilling apparatus is provided in Government emigrant ships, from which a supply of steam can always be obtained, of course diminishing the quantity of condensed water, which a few additional hours' distilling will compensate for, and will, in lieu, create at the time of the greatest need a "circulation of air" of vital consequence to the health of the emigrants. The action of a jet of steam is well known to carry up with it a quantity of air in proportion to the pressure from which it is liberated: a half-inch jet at 20 lbs. pressure, escaping at the rate of 2000 feet per second, led up a ventilator of two feet diameter, will exhaust the air through it at a velocity of twenty feet per second. But, though this is the manner in which it has been hitherto used, one-fourth the quantity of steam divided into a number of minute jets will create a draught of equal strength, with the additional advantage that the escape of steam is almost silent, whereas a large jet creates considerable noise. It will be seen that this velocity of 20 feet per second circulates upwards of 20,000 cubic feet of air per hour, double that caused by the unaided action of the wind, and at a time when such increased Ventilation is so much needed. In iron ships, where

timber spaces do not exist, or some vessels of war in which they are blocked up, the deck channel becomes available as a perfect means of communication with the mess deck. In steamers, the necessary up-draught is created by connecting the shaft with the funnel up which there is always a draught of from four to eight feet per second, and when steam is up from twenty to twenty-five. Hollow iron masts, which are now coming into very general use, are valuable ventilators in connexion with this system; they have a constant updraught of from four to ten feet per second. Doctor Edmunds has recenty received a report of the practical working of the system, first employed in the "Royal Sovereign," in 1863, for the Ventilation principally of the ship's framework, otherwise totally unprovided for; it answers this purpose perfectly, removing all foul smells from the bilges, and keeping the air of the between-decks pure; its utility is proved by their foul state returning whenever its action is suspended. Captain Sherard Osborne writes:—"I consider your apparatus well qualified to ventilate the decks of ships devoid of scuttles or ports, and I attribute to it much of the health and comfort my crew enjoyed in 'the Royal Sovereign.' Doctor Elliott, Surgeon of the ship, states:—'I have much pleasure in bearing testimony to your system of Ventilation, which has acted so thoroughly in removing the foul air from the bilges and hold of this ship; I consider it one of the best sanitary measures introduced on board Her Majesty's ships.' The Admiralty have directed Doctor Edmunds to prepare plans for most of the ships now being built. In the commencement of the year 1864, Her Majesty's Emigration Commissioners, ever anxious to make the Ventilation and other arrangements of their ships as perfect as possible, permitted Doctor Edmunds to carry out his system in three of the ships taken up by them—the 'Art Union,' the 'Earl Russell,' and the 'General Caulfield.'"

The Report upon the working of the system specially required by the Commissioners has established its success. The surgeon superintendent of the "Earl Russell" reported to the Commissioners that it was the most perfect system of Ventilation in theory and practice he had ever seen. Dr. Carroll of "The Art Union," in the course of an elaborate analysis of its effects, states that in the hot latitudes he found the temperature between decks lower than he had ever before experienced; very little unpleasant smell was observable in the between-decks, and the heated and foul air that is usually observed arising at night and from the deck ventilators was in this instance absent. In the calms about the Equator the steam jet was much used; the temperature during its use was reduced, and a very perceptible draught created, evinced by holding a candle at the air holes, and the strong current observable at the cowl head. In "The General Caulfield," in which ship I had an opportunity of testing Dr. Edmunds' apparatus, the results were fully in accordance with the foregoing statements. While the steam jet is in operation very little water can be obtained from an apparatus capable of distilling 500 gallons of water per day of twelve hours. An extra quantity of coal must therefore always be estimated for; I should

say about ten tons, the cost of which is quite insignificant in comparison to the valuable results accruing from the use of this apparatus. In a sanitary point of view, independent of the use of the steam jet, and depending on the wind, I consider it a vast improvement, superior to any other system of Ventilation I have ever examined in the course of my experience in superintending emigrant and passenger ships; and I can only conclude that in Dr. Edmunds' method we have every requirement to insure the effective Ventilation of vessels of war and passenger ships. In directing its adoption generally in the ships taken up for the conveyance of emigrants, Her Majesty's Emigration Commissioners have not only conferred a great boon on these poor people, by making their temporary abode upon the waters more healthful and agreeable, but the ships will also, in consequence of their timbers being kept dry and ventilated, resist the dry rot, and last longer—although this in the eyes of the philanthropist is a very secondary consideration to the preservation of life and health at sea. By conducting the steam jet into the ventilator we increase the current, and thereby discharge the foul air more rapidly—the conclusion arrived at being, that if we succeed in discharging the foul air, the vacant space will be occupied by pure. In the case of steamers we conduct the channel into the funnel, or, if preferred, connect it with the fireplace. As to the adaptability of the system for ventilating houses, I think a very simple arrangement would prove effective, by lifting some of the boards in each room, and converting the space between the joists into a box three sides air-tight, the bottom perforated with minute apertures penetrating through the ceiling of the room below, the air box to communicate through the medium of a tube with the flue, the updraught in which would be precisely similar to the funnel draught in steamers. By this simple arrangement the flues of rooms, at all times valuable ventilating agents, will be rendered more perfectly so, and the heated air of a room, ascending to the ceiling, more effectually carried off. To a certain extent also I should imagine this arrangement would be a remedy for smokey chimneys. To insure a supply of pure air, not generally obtainable in close narrow streets inhabited by a large population of the working classes, I would suggest an opening in the ceiling of the top landing, terminating in a cowl ventilator on the roof, arranged to turn with and towards the direction of the wind. This would insure the purest air obtainable being supplied to the staircase, hall, and passages. In the skirting board of the rooms the insertion of a perforated plate would admit this purer atmosphere. I should be glad to have the opinion of practical men as to the expense of this ventilating arrangement. I cannot think it would amount to more than a few pounds; and surely the owners of property let in tenements would not hesitate, if this may be deemed an important sanitary measure, to tax themselves in a small degree to increase the health, promote the happiness, and prolong the lives of a large and important section of the community.

XXXIV.—*The Icebergs of the Southern Hemisphere.* By J. M. BARRY, M.D., L.R.C.P.D., L.R.C.S.I., M.R.D.S., M.R.Z.S., &c., &c.

[Read May 15, 1865.]

THE Icebergs of the southern hemisphere possess so many points of interest and differ so considerably from those met with in the northern hemisphere, that I have thought a paper on the subject might prove somewhat interesting, more especially as I have recently received communications from practical men, accustomed to navigate annually that portion of the Southern Ocean most infested with ice impediments.

The points of greatest interest, perhaps, are whether Icebergs between fifty and sixty south latitude have of late years become more numerous?

Are they to be met with further west in the Pacific than formerly?

Do they last more than one season?

Where do they drift to?

And does their presence sensibly affect the temperature of the air and water?

I may first make a few general remarks on the subject, and then bring under your notice the communications alluded to.

The Icebergs of the southern hemisphere are much larger than those of the northern, being frequently reported by vessels as attaining an altitude of 1000 feet, 200 and 300 feet being their ordinary height, and from one to ten miles in circumference. In appearance they assume every variety of form, tabular, or irregular with hanging cliffs, penetrated with caverns; sometimes they shoot up picturesque pinnacles; they are at all times awful and imposing objects, especially during the prevalence of fogs and gales.

Icebergs appear to have their origin on or in close connexion with the land, and are generally the result of several years' frost.

The accumulated masses of snow and ice on the sides of mountains, and the glaciers formed in deep valleys, are gradually pushed towards the sea shore, increasing year by year into gigantic dimensions. Onward these ice cliffs, partly ice, partly snow, with rock gravel and earth imbedded in them—they creep along until projected into water sufficiently deep to float them, when enormous fragments become detached. Thus Icebergs are calved, and they drift to lower latitudes, melting by degrees with the increasing temperature.

Captain Ross sailed along land, in these Antarctic regions, fringed for upwards of 450 miles by an unbroken barrier of ice, 180 feet in height, flat and level at the top, without any fissure or prominence on its seaward face. Behind this wonderful object stood Mount Erebus, an active volcano, sending forth smoke and red flames. Ice detached from this barrier, as well as from other Antarctic shores, annually finds its way north into the track of homeward bound ships in the South Pacific, and encumbers the ocean chiefly between the parallels of 80° and 120°

west longitude—no parallel of latitude to the southward of 45° being probably altogether free from these obstructions to navigation.

One of the most remarkable instances I have found recorded of impediment from ice is the case of the "Arethusa," which vessel sailed from Van Diemen's Land on the 4th of January, 1833. She crossed in about lat. 57°; and it is probable, to judge from the report, that few vessels have encountered more danger, or seen a more continuous succession of Icebergs in the Southern Seas. The log says:—"We expected to see ice, but were totally unprepared for the hardships in store for us."

"The first ice fell in with consisted of fourteen ice islands, some of them 800 feet high. From this critical position we escaped only to fall in with an almost impassable barrier in lat. 57°, south, long. 93 W. There was ice as far as the eye could reach. Having entered the barrier, it became hazy, with small rain; the little distance we could see showed nothing but stupendous masses of solid ice of all possible shapes, the greatest distance between them being about a quarter of a mile. They were so closely packed together, that until nearly approached no opening could be observed. In passing some of the bergs the noise they made in cracking from the effects of thaw was awfully sublime, in many instances resembling a peal of thunder. The last Iceberg seen by the 'Arethusa' was in 78° W." For twenty days they were navigating through ice, during which the crew had little rest or comfort.

In September, 1840, an Iceberg was seen in lat. 41° 30′ S., long. 14° E., a mile in circumference; in February, 1848, in 48° S. long. 37½° E., a berg seven miles in extent was reported; in October, 1854, another equally large; in January, 1858, in lat. 53° 30′ south, and long. 51° W., an Iceberg three miles long was observed; but all these appear insignificant, when compared with a body of ice reported to have been passed by twenty-one ships during the month of December, 1854, and January, February, March, and April, 1855, floating in the South Atlantic, between latitude 40° south, long. 20° W., to 44° S. and 28° W. It was most probably an immense chain of Icebergs, its elevation in no case exceeding 100 feet. It was of a hooked-shape form, sixty miles by forty, with a space of water forming a bay forty miles across. The first account of it was received from the "Great Britain," which in December, 1854, was stated to have steamed fifty miles along the outer-side of the greatest limb.

The longest range of ice bore N. E. and S.W. The bay being open in this position, you will perceive it exposed ships to but little danger; but during the next three months it changed its position, and drifted E. N. E. about 100 miles, which brought it very near the route of outward bound ships, with the bay open to their track.

One emigrant ship, "The Guiding Star," was embayed, and lost among it, with all hands. The "Cambridge" and "Salem" were also embayed in it in March, 1855, but through the skill of their commanders were finally extracted from their most perilous situation.

There is a region in the South Atlantic which I have marked out on the chart before you, within which Icebergs more or less in number may be found at all seasons of the year. On the equatorial side of this curve ice is only found occasionally, and it is not improbable that many of the reported isles and shoals of the South Atlantic were bergs which had floated to low latitudes, freighted perhaps with masses of rock. Vast quantities of ice exist south of the parallel of 57° on each side of Cape Horn; it rarely, however, approaches close to the Cape. It is also found in great abundance between 49° and 55° S. between the meridians of 40° and 50°. The enormous masses found to the west of the meridian of Greenwich are formed on the land due south of Cape Horn. Explorers and persons engaged in the whale fishery tell us of vast accumulations of ice in this region; the entire space of water between some of the islands being filled with compact field-ice, and bergs sometimes as elevated as the islands. The average number of Icebergs to be met with to the southward of 57° during the Austral summer may be 100 per day. Storms in these regions are fearful. Icefields and floes, driven about under the agency of winds and currents, are piled up into ridges; coming into collision with Icebergs they are broken to pieces, and dashed about in all directions, and it requires the coolest courage and most practised skill to extricate a vessel.

The number of Icebergs obstructing the route of passenger ships varies annually. The reports of vessels show this to be the case. The records of Antarctic exploration endorse the same statement: if the quantity has been small during two or three years, the accumulated mass is subsequently disengaged, and finds its way north.

Sir James Ross crossed Weddel's track in latitude 65° S; and where Weddel found clear water Ross came upon an icepack, along which he sailed for 160 miles, only one degree beyond the track of Cook, who does not state that he was inconvenienced by ice in this position. Ross was navigating among it for fifty-six days.

From August, 1854, to April, 1855, the whole Southern Ocean, and especially that part of the Atlantic to the southward of the curve which I have laid down on the chart, was so occupied with ice, that no ship could sail through it without incurring great risk. The "Golden Era" was caught in it; the "Red Jacket" lost a week endeavouring to get clear of it; the "Champion of the Seas" had her homeward passage greatly prolonged; the "Cambridge" and the "Salem" were nearly lost, and the "Guiding Star" totally, with all hands.

The greatest number of Icebergs are met with between New Zealand and Cape Horn; and it is a mistake of serious consequence to suppose that they do not exist during the winter season. I am sure during the long winter nights vessels pass Icebergs unconsciously. The maxim ever should be, in prosecuting these passages, that ice must not *necessarily* be met with, but *may* be encountered at any season of the year. I may quote a few abstracts, illustrating the dangers encountered from Icebergs round the Cape of Good Hope and

Cape Horn, and between the two capes. H. M. ship "Sirius" sailed from Port Jackson in 1788; she fell in with Icebergs in lat. 57° S. and 76° west, and was constantly among Icebergs. Even when in sight of Terra del Fuego, being bound to the Cape of Good Hope, she passed across the dangerous track marked on the chart. Her log informs us that the sea was here covered with them; the last ice seen was in latitude 44° south, and longitude 35°. The "Seringapatam," on a voyage to Calcutta in 1840, fell in with ice in 38° S., and long. 1° E. The bergs were evidently breaking up; one berg upset, turning completely over; the ship was surrounded with ice for many hours. The "Constant," in September, 1844, saw thirty-two Icebergs in lat. 38°, and long. 24° E. "The Day Spring," on a voyage to the Mauritius, in December, 1855, in lat. 56° and long. 40°, sighted numerous ice islands, which seemed to form an impenetrable barrier. The ship was hauled to the northward, and continued to pass from ten to fifteen bergs a day, until she arrived at lat. 52°, and long. 20° west.

"The Crawfords" sailed from Callao in March, 1858, having rounded Cape Horn, and got as far to the north as 50°, kept to the eastward, and in consequence got among numerous Icebergs in long. 47°. The weight of experience is in favour of vessels, after rounding Cape Horn, steering a course to the northward, past the Falkland Islands, never going to the eastward of 50° W. long. until they are to the northward of lat. 50°; they should then not steer a more easterly course than would bring them to the point of junction of 40° south and 40° west.

I may be here permitted to remark, that having attained to this degree of northing, it is more prudent for vessels to get into the heart of the south-east trade. If northerly winds prevail, and they get down on the Brazilian coast, by keeping too long on the starboard tack, in the hope of the wind becoming easterly, they will have to beat up the coast from 20° south to a little north of Pernambuco, and it must be a smart ship that will beat sixty miles per day under these circumstances.

I was passenger on board ships on two occasions; on one we were detained thirty days, and in the other case seventeen, on this coast, daily expecting a change of wind to the southward of east; but in neither case did we fall in with a S. E. wind until we were to the northward of Pernambuco. One of these passages was in January, the other in May.

To return from this digression to the Icebergs—Maury, in his remarks on the "Icebergs of the Southern Seas," says that navigators can scarcely ever venture to the polar side of 55°, except while passing Cape Horn, without encountering Icebergs. They may be seen drifting up towards the Equator in large numbers all the year round, many of them miles in extent, and hundreds of feet thick. Maury informs us that he encountered bergs in the parallel of 37° south. The belt of ocean encircling the globe on the polar side of 56° is never free from them; this space comprehends an area of 17,784,600 square miles. The nursery for the bergs to fill such a field must be an immense one;

it cannot be on the sea, for icebergs require to be fastened to the shore until they attain full size; they are therefore evidence in favour of Antarctic shore lines of great extent, of deep bays where they may be formed, and lofty cliffs whence they may be launched.

From an examination of the logs of 372 English vessels outward round the Cape of Good Hope, and 192 round Cape Horn homeward, it appears that of the vessels round the Cape of Good Hope one in sixteen record ice, one in six of those round Cape Horn report Icebergs. With the exception of June and July, there is no perceptible difference in the average of years in the Cape Horn route; but the chance of encountering ice in sailing to the Colonies round the Cape of Good Hope is three times greater from September to May, both inclusive, than during the months of June, July, and August. It is an error to suppose that Icebergs require water seven times deeper than their apparent height above the sea level to float them; this altogether depends upon the solidity of the ice. Her Majesty's Ship "Chanticleer" was in contact with an Iceberg fifty feet high—which according to the rule would require not less than 350 feet to float it, but it was found to be drifting in ninety-six feet of water.

With respect to the increase of Icebergs of late years, Captain Henry of the "Omer Pasha," informs me that the increase of ice in the South Pacific since 1861 is most remarkable: previous to that year he made many passages from Australia at all seasons, running his easting down between 55° and 59° south latitude, and saw but little ice—in fact, three voyages not any; during the last four years they might be counted by hundreds each passage, some of them of immense size; in 1861 he saw a block of ice fully six miles along, and apparently 500 feet high, its sides quite perpendicular. "There can be little doubt," says Captain Henry, "that of late years there has been some enormous breaking up of ice in the southern hemisphere."

Captain Arnold, of the "Marco Polo," considers they are much more frequent of late years, and especially this season, which he thinks is marked by the presence of more ice in the South Pacific than any year since 1856; but thinks that it is unnecessary to look for any special cause further than the circumstance that, like many other natural phenomena, they are more frequently encountered some years than others.

Captain Johnstone, of the "Lightning," who has had great practical experience, having unfortunately run into an Iceberg when he commanded the "Marco Polo," is of opinion that ice is greatly on the increase in the South Pacific. He sailed from Melbourne in 1854, saw no ice; in July, 1859, did not encounter any, neither in 1860, in which year he sailed from Melbourne in March; sailing the same month, 1861, he saw the first ice in 53° S. and 170° W. longitude, in 160° W. saw much ice, then no more until he arrived at 55° S. and 142° W., when the ship came into collision with a large berg in the middle watch; at day-light the ship was in the centre of a great many bergs.

Captain Johnstone was so fortunate as to extricate his ship the "Marco Polo," which was in a most disabled condition, and brought her into Valparaiso.

All the ships which have arrived in London since February report having passed through immense numbers of bergs; one vessel states that Antipodes Island was sighted, four bergs being visible at the same time—this is most unusual; another ship states that ice was met with all across the Pacific, even to Cape Horn. This also differs from former experience, the vicinity of the Horn being usually free from ice impediments.

I have myself made six voyages round Cape Horn, and my observation leads me to conceive that there must be some agency in operation within the Antarctic circle recently, not hitherto existing, at least in so active a form, which may account for the great increase of Icebergs within the last two years.

In 1863 I returned home in the "Young Australia;" we fell in with ice in 120° W. long., and were clear of it finally when we were to the eastward of 101°.

This year, in the "Lightning," we sighted a berg in 175° W. or about 150 miles to the eastward of Antipodes Island; then again in 120° we continued passing ice to 74°, and counted more than 100 bergs. The weather during the greater part of the time being very foggy, we probably passed many more than we saw.

Captain Arnold thinks ice is more common now further west than formerly; at least, for some voyages, he has regularly met with ice between New Zealand and 180°, and a little south of latitude 50°. He attributes its being here, and again not for many degrees on either side of this position, to the current which sets to the southward past the east coast of Australia preventing any ice from working north in its influence, and again a broad southerly current which he believes exists between 130° and 180° W. He conceives that between these two there is a tongue of eddy current to the northward, which carries a few large bergs up, renewing them from time to time, as they melt irregularly, some seasons more, some less. Still the quantities of ice seen by several ships this season, scattered over the Pacific Ocean, would imply that there is some new current or other influence in operation. This is an interesting question for discussion.

As to the dissolving of the ice, Captain Arnold thinks some large bergs do not break up for several years, but that the changes in their surface, arising from their turning over, and the action of the air and water, would make it very difficult to recognise them. Captain Johnstone is of opinion that it would take years to melt some he has met with.

Captain Henry conceives that, from their magnitude, it would be impossible for them to dissolve every year; the time they last necessarily depending on the rapidity with which they are drifted to the northward; but if we are to take the estimated rate at which they are supposed to travel northward and eastward, it would take more than one season for

them to reach a parallel sufficiently genial to dissolve them with rapidity.

For my own part, I feel confident that two bergs I saw in 120° W. and 53° S. in the year 1863, were again sighted the following year in latitude 51° 40′, and 115° W. They were much worn; one had a hole in the centre, which at a distance looked like a mass of rock; the relative position of this to the rest of the berg, and the remarkable and peculiar outline of both, led me to exclaim at daylight on the 10th December last, when I was called up, "Surely I saw those bergs last year!"

To what extent does ice affect the temperature of air and water? On this point there is great diversity of opinion: navigators in the northern seas almost invariably have noticed the thermometer sensibly affected on approaching ice; and Mr. Towson, who has written much on the ice of the southern hemisphere, thinks a watchful attention to the change in the temperature of air and water the best guide navigators can have of approaching Icebergs.

Captain Johnstone found little change in his thermometer when in contact with the ice, and was watching it carefully for hours before the "Marco Polo" struck.

Captain Arnold thinks it very unsafe to rely on the thermometer indicating an approach to ice. He has often found it not at all affected, or very slightly, by the presence of large quantities of ice. He thinks the constant cold of the Iceberg region of the South Pacific prevents the thermometer being such a useful monitor as it is said to be in the North Atlantic.

Captain Henry informs me that he has only found the temperature affected when ice was dead to windward; for several voyages he paid particular attention to the thermometer, but latterly has given it up, as the difference was so little when among bergs and when none were in sight, that it can be no guide whatever.

He graphically observes, in his communication to me, that a good look-out kept by three or four hands is better than keeping your eyes fixed on a thermometer; and when it becomes so dark and thick that you cannot see, "Stop her."

Captain Henry, I should say, is a safe and judicious navigator in those dangerous waters.

Now, my own experience of the thermometer does not lead me to form a very favourable opinion as to its utility in indicating the approach to ice.

On the 14th January, 1864, I was in the South Pacific; for some days before, the temperature was 44° and 43°, the water 44° and 45°; on this day we encountered ice, the temperature of the air being 43°, water 44°. On the 20th, three days after we had seen ice, the temperature of the air was 42°, and the water, 44°.

On the 9th of December, with ice in sight, the air was 48°, and the water 42°. This would seem to imply that the water was affected by

the presence of the bergs; but off Cape Horn, on the 17th, we have the temperature of the air 45°, three degrees lower than it was on the 9th with bergs all round.

From the observation of successive years I would conclude that the thermometer, if closely watched, will show a difference of temperature in air and water when in the vicinity of these ice islands; but the difference is often so trifling, and requires such a good instrument and close observation as to render an ordinary thermometer on the deck of a ship, or the occasional testing of a bucket of sea water, quite useless in a practical point of view; and the fact of no change being observed in the temperature would certainly not warrant the commander of a ship in running during a dark thick night. The cause of the disaster to the "Indian Queen"—which vessel ran into an Iceberg, narrowly escaping destruction—was probably due to the opinion prevailing at that period as to the infallibility of the thermometer indicating the approach to ice. It is right, however, to state that some persons are of opinion that both sea and air are influenced by the vicinity of Icebergs; and that the not infrequent fogs which occur about them is caused by the condensation of aqueous vapour. When to the leeward of ice, the air is cool; when to windward, the water through which the ice has drifted is cooler.

My experience does not lead me to coincide with the correctness of this view, or, at all events, of its application practically in navigating ships through icy seas.

Captain Macdonald, when in the "James Baines," often met with a considerable number of Icebergs in his Australian passages; but is of opinion that they do not materially increase the risk, as it is only requisite to notice the thermometer to be forewarned of the approaching danger. In one case he found the thermometer fell four degrees as he approached the ice, and two more as he got to leeward of the berg.

The log of another ship informs us the thermometer in the morning indicated a temperature of 49°, and fell to 42° at mid-day on approaching towards an Iceberg.

Captain Newland, in the log of the "Champion of the Seas," states that the thermometer not only indicates the approach towards ice, but also the amount we may expect to meet with.

In latitude 58½° south he passed two Icebergs, the temperature of the air being 42°, and water 44°. He passed thirty-nine Icebergs in lat. 50°, the thermometer falling to 36°. In this instance the temperature was some six or eight degrees lower, although the ship was some eight degrees nearer the Equator, at which point the mean temperature is ten degrees higher.

The reports informing us that the thermometer is not at all affected by the neighbourhood of Icebergs are very numerous indeed, and should impress on all rational minds the necessity of keeping a most careful look-out night and day.

The late Dr. Scoresby, in his "Journal of a Voyage to Australia and Round the World," remarks on the subject under our consideration,

that he cannot agree with Mr. Towson's view as to the security against falling in with ice to be derived from watchful attention to the temperature of the sea, or the thermometer being capable of insuring safety by giving indications of an approach towards ice. No doubt, in the vicinity of large bodies of packed ice, or of numerous Icebergs near together, the thermometer will show a reduction in the temperature of air and water in certain relations to the direction of the drift of the ice, sometimes to considerable distances. The unusual lowness of the temperature of the water indicates a descending polar current, and therefore a greater probability of ice being met with; but it is impossible to apply these changes of temperature in air or water with any certainty to determine the approach to ice. It is an excellent practice to note the temperature of the sea in these regions, provided we do not altogether rely on thermometric indications. The chilling or radiating influence of an isolated Iceberg cannot sensibly affect the temperature of the air to windward of it, nor could the sea be altered in its general temperature for miles around, except in the track of the drifting bergs. Fragments of bergs in a gale and heavy sea will always be found nearly a stream of the Iceberg—that is to say, in the line of the wind from the berg to windward or to leeward. Hence, it is a useful precaution, in sailing among Icebergs at night, to pass them well on one side with respect to the direction of the wind, so as not to intersect the stream line of the ice. Next to a careful look-out, the most important circumstance to be attended to is, giving such attention to the adjustment and quantity of sail during the night or misty weather, when ice has been seen, or may be reasonably supposed to be not far off, as may allow for hauling up or bearing away in the event of sudden necessity. In the long dark nights of winter, when the moon is not nearly full, ice, particularly the low, less visible fragments, are specially to be guarded against. In the summer of the Southern Seas there is so little night, that ships may run with security, provided the weather is clear. Unfortunately fogs are but too frequent with the prevailing north-westerly winds. Lastly, it is to be hoped that the experience of future years will convince navigators, if indeed we have not already acquired information sufficient to satisfy commanders of ships, that as good passages may be made from Australia to Cape Horn by running down their easting in 50°, as far as 110° or 115° W. long., and then edging down to Cape Horn in 55° 58′, as by incurring the great risk, without any commensurate advantage, of going as far south as 60° for the sake of shortening the distance some 500 miles; it cannot be with the hope of having fairer winds, for the weight of experience is in favour of easterly winds prevailing to the southward of 60°, and the parallel of 45° on the outward bound passage is deemed the parallel where the brave west winds most steadily blow during a greater part of the year. I have spoken to several of the most experienced commanders in the Australian trade, and they all agree with me as to the views which I put forward on this point. I trust that this slight sketch of the ice phenomena met with by voyagers in the Southern Seas may only prove the prelude to other

papers of greater extent and value. I know not a more interesting field for observation, or more calculated to elevate our minds, than the physical geography of the ocean.

XXXV.—*On the Chemical Value of Manures, and the Silurian Limestone of Courtown Harbour, County of Wexford.* By GEORGE WALLER, C. E.

[Read April 24, 1865.]

AT an evening meeting held here during the Spring Cattle Show of last year, a Paper was read by Mr. Lawes, "Upon the Feeding of Cattle;" and in connexion with the subject he stated, "that it was unnecessary to supply carbon in a manure, inasmuch as a manure without carbon produced a crop superior to that in which carbon had been largely supplied." He then pointed out the value of nitrogen in manures. At the close of the lecture I rose to ask Mr. Lawes the question if, as he affirmed, it was unnecessary to supply carbon in a manure, why was it necessary to supply nitrogen, both elements being derived from the same source, the atmosphere, and supplied gratuitously by it?—that I was acquainted with a manure which contained neither carbon nor nitrogen, and that on light lands it had proved itself equal to, if not superior to, all known manures (farm-yard not excepted), not in the production of one or two crops, leaving the land permanently exhausted, but in the production of a series of good crops; that it enabled light lands to produce herbage vastly superior to that which could be produced by any other manure. and that I used to exhibit specimens of herbage produced by it, and from the *debris* of the stone, without the presence of any dirt, which I now do; that it seemed to be the peculiar property of this manure to produce this herbage upon all the lands to which it was applied; that it contains only a trace of phosphate, and yet is capable of producing a series of good corn crops on the most exhausted light lands; that it is valuable also as an hydraulic lime. I alluded to the Silurian Limestone of Courtown Harbour, near Gorey, in the county of Wexford—a conglomerate Limestone, perhaps the only known variety in which all the earthy constituents of grain crops, green crops, and grass exist in certain proportions, and in certain chemical combinations, peculiarly fitted, as it were, for the production of these crops.

Before noticing the components of this Limestone, and thence deducing its value as a manure, I propose to offer a few remarks respecting the constituents of plants and the sources from which they derive their food; for we must understand the composition of a plant before we can affirm the class of food required for its growth and development. Agricultural plants, as many of you are aware, are composed of two classes of constituents—the combustible, or gaseous, which are derived from the atmosphere; and the incombustible or earthy, which are de-

rived from the soil. The combustible, or gaseous, constituents are composed of oxygen, hydrogen, nitrogen, and carbon, and are derived from carbonic acid, water, and ammonia. When a plant is subjected to the action of fire, or during decomposition, these combustible constituents return to the atmosphere whence they were derived, leaving behind the incombustible, or earthy, in the form of ashes. The incombustible, or earthy constituents of plants left behind in the form of ashes, are composed of phosphoric acid, potash, silicic and sulphuric acids, lime, magnesia, iron, and chloride of sodium, all of which are indispensably necessary for the growth and development of the plant. If there be a deficiency of any one of these constituents in the soil, the deficient constituent must be supplied artificially. Now, as there is always a large supply of carbon, oxygen, hydrogen, and nitrogen in the air to form carbonic acid and ammonia, it is unnecessary to supply that which is gratuitously supplied by the atmosphere. Our attention should rather be given to the supply of the incombustible, or earthy, constituents, which are not supplied by the atmosphere, and which, if removed from the soil by cropping, cannot be restored unless by artificial means.

But in order to understand the particular incombustible, or earthy, constituents we are to supply, it is necessary to determine the class of crop we purpose to grow. This being determined, we know from analysis the principal incombustible, or earthy, constituent which that crop requires for its growth and development. Now, as silex, lime, potash, and soda, respectively, predominate in the ashes of our cultivated plants, so these plants have been known under the name of silex plants, lime plants, potash and soda plants; silex predominating in the ashes of corn plants and grass, lime predominating in the ashes of potatoes and leguminous crops, potash and soda predominating in the ashes of green crops. We may, therefore, fairly infer that soluble silex, not insoluble or green silex, should predominate in any food we supply for the production of corn crops or grass; lime in any food we supply for the production of potatoes or leguminous crops; and potash and soda in any food we supply for the production of green crops; and we may also infer, that if these minerals do not predominate in any food we supply for the production of these crops, respectively—nay, further, if we do not supply as much of these minerals as we remove by these crops, respectively—the impoverishment of the soil must follow, as a matter of course.

Now, as artificial manures supply only about half the quantity of incombustible, or earthy, constituents that is removed by one of our cultivated crops; and as by the supply of combustible, or gaseous, constituents they stimulate the soil to yield much larger quantities of incombustible, or earthy, constituents than they supply, so I may fairly affirm that artificial manures, used as manures, or in place of manures, tend to exhaust and impoverish the land, and deprive it of its fertility; but when these manures are used as stimulants for the production of green crops to be fed off upon, or ploughed into the same land, or car-

ried to the farm-yard to be converted into manure for the same land, or, in other words, when these so-called manures are used as stimulants for the production of manure for the same land the following season, no one will advocate their value more strongly than I would.

Unfortunately, however, they are not always purchased with this object in view. Within the last few years they have been extensively used by the small farmers in the county of Wexford (most probably in other counties also), as a substitute for manure in the production of green crops—the number of cattle on such farms being small, but now considerably reduced, from the past failures of crops, and bad prices; the quantity of manure on such farms being also always small, but now also considerably reduced—whilst from time to time these lands have been exhausted from over-cropping, and then stimulated by over-liming. To enable these lands to recover their fertility, artificial manure is purchased, a green crop produced, and the farmer proceeds to lay down the land the following year in good condition with a crop of corn and grass seeds, or he proceeds, before doing so, to take off a crop or two of corn, to repay himself for his outlay. He finds himself, however, miserably disappointed in the results. He is not aware that green crops are the most exhausting crops he can cultivate; "for," says Liebig, in his "Letters on Agricultural Chemistry," p. 129, "turnips require for their growth a very large quantity of mineral matter." Again, p. 131, "the quantity of food which a plant obtains from the same soil is in proportion to its absorbent root surface;" and as in the green crops he has removed from the soil a larger quantity of the incombustible, or earthy, constituents than he has supplied in the artificial manure, the deterioration of the soil must follow as a matter of course. In fine, the supply of artificial manures to such lands under the circumstances would be analogous to the supply of whiskey to an exhausted labourer, with a view of stimulating him to exertion beyond his natural strength.

Now, whilst landlords are being alarmed about over-liming, they are little aware of the greater injury resulting from the injudicious use of artificial manures. I have already observed that, when farmyard manure cannot be procured in sufficient quantity for the production of green crops, I would recommend the purchase of artificial manures, the crop when raised to be ploughed in or fed off upon the same land, or else the crop to be removed to the farmyard, there to be converted into manure to be restored to the same land. It matters little which of these three systems are pursued—they are all alike beneficial to the land; the first can be pursued by the farmer who has little or no stock, but is the most unprofitable; the second can be pursued with great advantage on light land and high-lying farms, and is the most profitable, because attended with the least possible outlay; the third entails the expense of carting the crop to the farmyard to be converted into manure, and the expense of re-carting it to the land when converted into manure, and is suited for farms where cattle must be housed

during the winter months. In each of these three cases the minerals removed by the crop are restored either by ploughing in the entire crop, or in decomposing it on the ground, and ploughing in the decomposed crop, or in the restoring to the ground the crop decomposed in the farmyard, which latter has probably the added incombustible constituents of the straw and hay and corn upon which the animals in the farmyard have been fed.

Having now pointed out the circumstances under which artificial manures exhaust and impoverish the soil, and the circumstances under which they may be made the means of improving the soil, I now come to consider the means of maintaining the fertility of our well-cultivated farms. "There exists," says Liebig, "a receipt for insuring the fertility of our fields and the permanence of their crops, and which, properly and consistently applied, will prove more remunerative than all the expedients that have ever before been resorted to by agriculturists; it consists in the following rule:—Every farmer who takes a sack of corn, or a hundred weight of rape, turnips, potatoes, &c., to the town ought, like the Chinese coolie, to carry back with him from the town an equal, or, if possible, a larger quantity of the mineral constituents of the produce sold, and restore them to the field from which they have been taken." Accordingly, when an alternate system of husbandry is pursued upon a farm, the grain produced is sold in the market, and is not restored to the land in the form of manure; and as the head of corn cannot be produced without the presence of lime, I would say, purchase annually a certain amount of lime to supply the lime constituents sold in the market in the form of grain, or use marl, when marl can be obtained; by such means the fertility of their farms will be maintained.

I shall conclude by a testimonial given by Mr. Richards, of Ardamine, January 22, 1861, attesting its value in growing mangolds:—"The mangold wurtzell grown on my land this year on Courtown lime were far superior to those alongside grown on guano and on Lawes' superphosphate, a fair trial having been given in contiguous drills. The land had been manured under beans the previous year. The return of the produce of each drill when pulled was, under lime, 19½ stones; under guano, 15 stones; under superphosphate, nine stones." The herbage I exhibited this evening is grown on the *debris* of the limestone, and below the level of the sea, and has sprung up spontaneously. The variety, I believe, is not known in agriculture; and I believe, considering the season of the year, in specimens I may challenge competition. A similar one may be seen in abundance growing among the rocks at the works.

XXXVI.—*On a New Table and Formula for determining Altitudes with the Barometer.* By STEPHEN M. YEATES.

[Read January 13, 1865.]

THE extreme portability of the Aneröid Barometer having made it a favourite companion of almost every tourist, the want of some ready and accurate method of deducing heights from its indications has been much felt. One of the first steps this way is a little pamphlet, published by Mr. Belville, of the Royal Observatory, Greenwich, in which he gives the following simple rule:—"As the sum of the readings of the Barometer is to their difference, so is 55,000 to the elevation required." He also gives a Table, computed by the same rule, which is intended to give at a glance the approximate height corresponding to any depression of the Barometer; but as the altitudes given by the Table vary in many cases several hundred feet from the true height, it is quite useless.

Admiral Fitzroy suggested a modification of Mr. Belville's formula, and computed a new Table, which has been published by the Board of Trade; but this has the same objection as Mr. Belville's, and gives results nearly as remote from the truth; and what renders them still more useless is, that no correction for any change in the atmosphere can be applied to either so as to obtain more accurate results. This arises from the most important element—namely, temperature—not being taken into consideration in the formula.

Upon thinking over the matter, I considered that a more useful Table might be constructed by computing the altitudes corresponding to every twentieth of an inch of the mercurial column at one fixed temperature and latitude. These conditions being known, a correction might easily be applied for any change in either; accordingly, the following Table has been computed throughout for the mean temperature—32° Fahrenheit, and latitude 45°. To correct it for any other temperature, it is only necessary to increase or decrease it by the $\frac{1}{900}$th of itself for every degree of difference between the temperature of the air at the time of observation and that at which the Table has been computed. Thus—if t and t' denote the temperature of the air at the upper and lower stations, h the height given by the Table, and l the tabular number for the latitude, then

$$\frac{(t + t' - 64)h}{900} + h = H$$

and

$$H + (Hl) = \text{true height.}$$

The correction for latitude is + for all latitudes from 0° to 45°, and − from 45° to 90°. In most cases it may be neglected altogether, as the greatest error that could arise from its neglect in the most extreme case would be very small; so that for all practical purposes H may be taken as the true height.

NOTE.—If this Table be used with the Mercurial Barometer, the two readings of the Barometer must be reduced to one temperature, by increasing the colder the $\frac{1}{10000}$th of its height for every degree of difference of temperature.

Height in Feet.	Bar.	Height in Feet.	Bar.	Height in Feet.	Bar.	Height in Feet.	Bar.	Height in Feet.	Bar.	Height in Feet.
00	28·00	2667	25·00	5638	22·00	8988	19·00	12830	16·00	17334
42	27·95	2714	24·95	5690	21·95	9048	18·95	12899	15·95	17416
85	·90	2762	·90	5743	·90	9108	·90	12969	·90	17498
127	·85	2809	·85	5796	·85	9168	·85	13038	·85	17581
170	·80	2856	·80	5848	·80	9227	80	13108	·80	17663
212	·75	2903	·75	5901	·75	9287	·75	13177	·75	17746
255	·70	2950	·70	5954	·70	9348	·70	13247	·70	17830
298	·65	2997	65	6007	65	9409	·65	13318	·65	17918
340	·60	3045	·60	6061	·60	9469	·60	13388	·60	17997
383	·55	3092	·55	6114	·55	9530	·55	13459	·55	18081
426	27·50	3140	24·50	6167	21·50	9590	18·50	13529	15·50	18166
469	·45	3188	·45	6221	·45	9652	·45	13600	·45	18251
512	·40	3235	·40	6275	·40	9713	·40	13671	·40	18336
555	·35	3283	·35	6328	·35	9774	·35	13743	·35	18421
599	·30	3331	·30	6382	·30	9836	·30	13814	·30	18506
642	·25	3379	·25	6436	·25	9897	·25	13885	·25	18592
685	·20	3427	·20	6490	·20	9959	·20	13958	·20	18678
729	·15	3476	·15	6544	·15	10021	·15	14030	·15	18765
772	·10	3524	·10	6599	·10	10083	·10	14102	·10	18851
816	·05	3572	·05	6653	·05	10145	·05	14175	·05	18938
859	27·00	3621	24·00	6707	21·00	10207	18·00	14247	15·00	19025
903	26·95	3669	23·95	6762	20·95	10270	17·95	14320	14·95	19113
947	·90	3718	·90	6817	·90	10333	·90	14393	·90	19200
991	·85	3767	·85	6872	·85	10395	·85	14466	·85	19288
1035	·80	3815	·80	6927	·80	10458	·80	14540	·80	19377
1079	·75	3864	·75	6982	·75	10521	·75	14613	·75	19466
1123	·70	3914	·70	7037	·70	10584	·70	14687	·70	19555
1167	·65	3963	·65	7093	·65	10648	·65	14761	·65	19644
1211	·60	4012	60	7148	·60	10711	·60	14836	·60	19733
1255	·55	4061	·55	7204	·55	10775	·55	14910	·55	19823
1300	26·50	4110	23·50	7259	20·50	10839	17·50	14985	14·50	19914
1345	·45	4160	45	7315	·45	10903	·45	15060	·45	20004
1389	·40	4210	·40	7371	·40	10967	·40	15135	·40	20095
1434	·35	4260	·35	7427	·35	11031	·35	15211	·35	20186
1478	·30	4309	·30	7483	·30	11096	·30	15286	·30	20278
1523	·25	4359	·25	7539	·25	11160	·25	15362	·25	20370
1568	·20	4409	20	7596	·20	11225	·20	15438	·20	20462
1613	·15	4459	·15	7653	·15	11290	15	15515	·15	20554
1658	·10	4509	·10	7709	·10	11355	·10	15591	·10	20647
1703	·05	4560	·05	7766	·05	11421	·05	15668	·05	20740
1748	26·00	4610	23·00	7823	20·00	11486	17·00	15745	14·00	20833
1793	25·95	4660	22·95	7880	19·95	11552	16·95	15822		
1839	·90	4711	·90	7937	·90	11618	·90	15900		
1884	·85	4762	·85	7995	·85	11683	·85	15977		
1929	·80	4812	·80	8052	·80	11749	·80	16055		
1975	·75	4863	·75	8109	·75	11815	·75	16133		
2021	·70	4914	·70	8167	·70	11882	·70	16212		
2066	·65	4965	·65	8225	·65	11949	·65	16290		
2112	·60	5016	·60	8283	·60	12016	·60	16369		
2158	·55	5067	·55	8341	·55	12082	·55	16448		
2204	25·50	5119	22·50	8399	19·50	12149	16·50	16527		
2250	·45	5170	·45	8457	·45	12217	·45	16607		
2296	·40	5222	·40	8516	·40	12284	·40	16687		
2342	·35	5274	·35	8575	·35	12352	·35	16767		
2388	·30	5325	·30	8633	·30	12420	·30	16847		
2435	·25	5377	·25	8692	·25	12487	·25	16927		
2481	·20	5429	·20	8751	·20	12556	·20	17008		
2528	·15	5481	·15	8810	·15	12624	·15	17089		
2574	·10	5533	·10	8869	·10	12693	·10	17170		
2621	·05	5585	·05	8929	·05	12761	·05	17252		
2667	25·00	5638	22·00	8988	19·00	12830	16·00	17334		

LATITUDE.

−		+
45	0·0000	45
50	0·0005	40
55	0·0009	35
60	0·0013	30
65	0·0017	25
70	0·0021	20
75	0·0023	15
80	0·0025	10
85	0·0027	5
90	0·0027	0

XXXVII.—*On the Neglect of Sanitary Arrangements in the Homes and Houses of the Rich and Poor, in Town and Country.* By EVORY KENNEDY, M. D., E. & DUBL. (Hon.); Fellow and past President of the King and Queen's College of Physicians in Ireland, &c.

[Read February 23, 1865.]

LET us ask, What is the necessity for dealing with our present subject? Dr. Guy's calculation of the mortality in large towns, published in 1846, furnishes the best answer. Take the average healthy standard of mortality in these at 1 in 45, and compare it with the absolute general standard of mortality, 1 in 50. This leaves an excess of two per cent. of what may be termed unnecessary deaths, or 8000 in every 1,000,000 inhabitants. This would make in the three kingdoms an annual unnecessary loss of 60,000 lives. Then take Dr. Playfair's calculation, that for every death there occur twenty-eight attacks of sickness, or cases of morbility. That would give $1\frac{3}{4}$ million of cases of unnecessary sickness; but say we place it at one million, the result of a different method of calculus, all of this million, with its incalculable suffering, torture, grief, and misery, might have been prevented! What an appalling consideration is this to us as responsible members of society! But, as some of us cannot be aroused to think of anything that does not touch our pockets, I may state the money loss to the community resulting from this morbility and mortality to amount, according to the best authorities, to nearly £20,000,000. Another way of looking at the matter is, the comparative mortality of the gentry and labouring classes in certain streets in some of our cities, say in London; the average life of the former being forty, whilst that of the latter is only seventeen years—that is to say, they lose twenty-three years of their lives, one with another. I do not envy the selfish member of society, who, with a knowledge of this fact, can look on with tacit indifference at such a disproportion in the enjoyment of God's great gift of life—a gift thus wantonly cast away through man's mismanagement.

In considering the important subject of sanitary reform, the conviction must come home to every thoughtful man, that, without delaying to accomplish great things, such as now occupy so much public attention, there is much to be done towards lessening mortality, and improving the health of the community, by attention to smaller matters, within the reach of every man. The neglect of these is daily fraught with the development of disease and death in this metropolis and throughout the country. Whilst we are perhaps engaged in concentrating our attention upon those general sanitary improvements, such as now, at the eleventh hour, force themselves upon the attention of our legislators and civic authorities, let us also exert that home care and solicitude that not only tell more immediately, but, I hesitate not to add, more effectually, in the prevention of disease than all the steps that can be adopted by the public authorities. What signifies it to me, as a father of a family, responsible for the safety and health of my children and domestics, whether the system of public sewage be the most per-

fect and complete, if my house, through my own neglect or ignorance, be a receiver for the noxious gases with which these sewers are charged; or what do I gain by the establishment of a system, which, although it purifies the atmosphere without my house, breathed by my family for perhaps two or three hours a day, yet absolutely concentrates within my house the noxious effluvia inhaled by my family for twenty-one hours each day? At night, also, it must be recollected, the body is more susceptible of disease, and the doors and windows closed; thus concentrating those poisons most when we are sure to be exposed to them under the greatest disadvantages.

As my object in the following paper is to afford a few practical hints to householders and heads of families, I shall endeavour to convey myself in the most simple language, avoiding all technical terms and scientific display. If my more scientific hearers should, as no doubt many of them will, pronounce the subjects treated in it as trite and commonplace, I shall admit the impeachment, and merely answer that my object is to render them still more so. Although amongst the enlightened individuals surrounding me there may not be one sentiment announced or one principle propounded with which you are not familiar, and of which, in the words of the philosopher, as applied to geology, you may still know nothing "that it would not be a disgrace to an English gentleman to be ignorant of," yet experience of the habits of the rich and the poor in this city and country have left the conviction on my mind that they require to be inculcated and insisted upon, as the simplest sanitary and health-procuring principles are totally neglected amongst them individually, and consequently that our disease and mortality are greatly increased from this neglect. I need only refer to our weekly returns to establish this conviction in your minds also.

We talk of the filthy exhalations that pervade the hovels and crowded lodgings of the poor, and with great justice, as these demand our closest attention; but we little dream that the atmosphere breathed in some of our most respectable houses, nay, in many of our most stately mansions, is as foul, as fatal, and as deadly as that in the houses of the most wretched of our population. Full often have I traced to this cause disease that undermined the health and paled the cheek of the junior members of some of our most refined and highest families.

SEWERAGE.

Let us now see how this occurs. Nearly every house is provided with a sink, or receptacle for slops, which communicates with the general sewerage of the city through a special or branch sewer that leads from each house, and which generally traverses the basement. These sinks are, in some cases, in the kitchens; in others, in sculleries, or small chambers attached to the kitchens.

The air that pervades the sewer is cold, that which occupies the kitchen is hotter, therefore of less specific gravity, or, in plain language, lighter. The tendency of the lighter air is to float upwards, and the result is that the cold air rushes up to replace the vacuum thus formed. The effect, then, of allowing a communication to exist between the sewer and the air of the house is obvious. The heated air of the

kitchen is constantly rising until it reaches the highest apartment in the house; as it does so, it is replaced by the colder air from the sewer, loaded with its poisonous gases. In other words, the house becomes a chimney to the sewer, through which the foul atmosphere is exhausted, in addition to its being a generating laboratory developing its own supply. This, I regret to say, is the case with a large proportion of the houses of the rich, as well as of the poor in this city. The cure for this generally had recourse to is, flushing out the sewer, or lifting the cover of the house sewer and cleaning it out. Both of these expedients, although beneficial, add to the fœtid exhalation for the time, and disappoint the house occupier by leaving the nuisance afterwards where it stood, or worse. What every housekeeper should look to is the preventing any possible return of noxious air, by cutting off the communication for gases between the house sewer and the house, but retaining the communication for fluids or slops. This is done in the simplest manner, at the expense of a few shillings, by interposing between the sink or slop trough and the house sewer a water valve, which admits of the escape of fluids, but prevents the return of gases. Let me request every man who hears this to walk down to his scullery, light a candle, and hold the flame of it directly over the opening leading from the sink trough to the house sewer; and if the flame of the candle be blown up perpendicularly by the rush of foul air, let him immediately have a water valve interposed. But let him recollect that if a rat-hole remain, keeping up a communication between his house and the general sewerage, he is still exposed to the influence of the poison.

SEWAGE IN COUNTRY HOUSES.

Let not our apparently more favoured neighbours who reside in the healthiest localities in the country districts imagine that locality alone secures them an immunity from the disease and mortality ascribable to neglect of the precautions here insisted on. True, they may plume themselves with the idea that they are far removed from the murky atmosphere above, and the noisome filth rivers beneath, that pervade city districts. But I grieve to say that I have frequently been stifled with the sewerage exhalations that have met me on stepping into country houses placed in the most salubrious and enviable positions. Infantile intermittent was, insidiously perhaps, doing its work of death in their admired retreat. The astonished parents, who had laid out thousands in embellishing their charming villa or mansion, were horrified with the announcement that the air of their paradise was poisoning their child, and that the only hope of saving it was an immediate change. On searching into the cause of this, a cesspool perhaps tastefully covered over in the parterre, or an escape from the sewer saturating the earth on which the house rested— perhaps an open-mouthed filth channel, causing an increase of stench on change of wind, but always securing a poisonous admixture in the house atmosphere through its untrapped sink or slop receiver—was the cause of the worm in their gourd.

Let us, then, also advise our country friends to apply their candle to their sink and slop openings; to trap them, if necessary; to see that

their sewerage is perfect, and if not, to lay down earthenware pipes at once to receive it. Let them look to their cesspools; if within three hundred yards of their houses, let them fill them up, and open new ones at that distance at least, securing, if possible, a good fall and an ample supply of water to carry off the solid matter. By lining the cesspools with cement they may be rendered economical, and subsidiary to farming or gardening uses.

The use of earthenware tubes for carrying off house sewage is one of the greatest practical improvements in modern domestic architecture, and should be had recourse to in all cases where it is necessary to renew or originate sewers.

However carefully prepared the masonry sewers may be, escape of the fluid contents will occur; rats and other vermin will open communications with them in course of time, and, the fluid contents of the sewer welling out, the clay of the basement story is converted into an earth sponge of poison-exhaling vapours, undermining the health of our domestics, who usually reside in them, if it do not also extend its influence to the family in the upper chambers. I had some years since an opportunity of examining a case of this kind in a spacious mansion in which I desired attention to be paid to trapping the sinks. This was done, but still the inconvenience remained, attended with an unpleasant exhalation in the basement story. The sewers were then examined, when it was found that these, which had been built a long time, were permeated with rat-holes, through which the fluid escaped freely at several places, but particularly at one place—directly under the boarded floor of the sleeping room of the butler, where a floating mass of several tons of liquid of the consistence of thin treacle rested upon the earth, which was throughout the base of the house thoroughly saturated with the constantly escaping liquid. Chloride of lime was thrown down, earthenware pipes substituted for the old house sewer, with a good fall to the main drain, when all inconvenience was removed, and the house was rendered healthy.

It is to be observed that suburban residences are generally in a worse position as regards sewage than those either in town or country, as they rarely can avail themselves of the main sewers of the cities, and are unprovided with substitutes.

I regret to state, a large proportion of even the most enlightened members of society are in ignorance of what becomes of the sewage of their own houses, whilst any public measure calls their energies into immediate activity. Would that their charity would begin at home. Would that the population of this city could be induced to pay a tithe of the attention they devote in studying the merits of the general sewage of Dublin, which, albeit capable of much improvement, is by no means in the deplorable state represented, to securing the simplest and most obvious sanatory arrangements in their own houses.

CONTAMINATION OF PUMPS AND WELLS.

My attention has been drawn to more than one instance in which the foulness and fœtor of the water drawn from the pumps led to the

discovery that the well and an imperfect house sewer or cesspool were in close proximity. There is no excuse, with our recent improvements in the street sewers of this city, which reflect the highest credit on their managers, for the continuance of such private, nay, we may say public, nuisances. The corporate authorities afford spacious well-trapped sewers within a few feet of our hall-doors with ample fall, and every facility for availing ourselves of them.

Where a main sewer does not at present exist, the inhabitants of the locality have only to call for it; yet, I regret to say, the proportion of houses in which no connexion with the improved main sewer has been established is incredible. I could mention one fashionable street, containing about thirty houses, in which only three houses have communications with the newly constructed main sewer. Those who have not such connexion are dependent upon imperfect sewerage, laid upon old and defective levels, upon open ditches, or upon cesspools. These should be looked to by the police as a public nuisance, on the principle of their poisoning the atmosphere and the soil.

Whatever originates zymotic or infectious disease is a public nuisance, and the accumulated evidence of the most reliable authorities tends to the conclusion that they do so. Zymotic disease is doubly a nuisance; first, in its production, which is unfortunately not confined to the sordid or negligent man who called it out; but, secondly, from its extension through contagion, which allows of no limits to the mischief it may inflict. One citizen takes every pains to render safe not only his sewerage, but to have the purest drinking water. He sinks a pump seventy feet through the bed of limestone gravel on which we sit, and taps his neighbour's leaking sewer, manure heap, or cesspool, in the process. Or perhaps his predecessor has had a well which for fifty years has been the pride of the district; his neighbour neglects his sewerage, or allows his surface water to wash the contents of his ashpit or cloaca into the soil close by, and he finds his drinking water charged with sulphuretted hydrogen. The negligent neighbour poisons the inhabitants of the street by not trapping his surface water sewer, and by the nuisances in his area, although the city authorities possess ample powers to correct these, and have gone to large expense to trap the public sewers most effectually.

We are not, however, to suppose, strong as the evidence may appear when sulphuretted hydrogen is found in water, that animal excrement has entered the well. I send you round a specimen of water in which no such cause could be assigned, and yet the waters of Harrowgate are not more charged with it. This is ascribed to the insertion of a pump made of Memel timber some months before the gaseous poison was detected. The water, I should mention, was perfectly pure for eight years before the insertion of the Memel pump; nor is this the only case that has come to my knowledge of such a result from a Memel pump. I have submitted this matter to the investigation of Professor Barker, whose admirable paper read on the subject of "Water" before our Society renders quite superfluous my dealing with this impertant branch of my subject further. I doubt not he will furnish us with an explanation of this phenomenon.

CONTAGION, HOW DISSEMINATED.

Whatever precautions we may take in our houses, there can be no security against the spread of epidemic or contagious diseases, if proper police regulations be not insisted on in places where the upper as well as the lower classes must be exposed to their influence. This raises the question of our public assemblies, churches, courts of justice, theatres, and other buildings, our hotels and lodging houses for rich and poor, and our public conveyances. It is difficult to reach the case of people frequenting churches and other public assemblies charged with infection; and a moral conviction of the impropriety of spreading disease and suffering, perhaps of inflicting manslaughter, through their want of the application of the golden rule, must, I fear, continue the only check to the practice.

In Continental countries it is not found impracticable to bring the proper management of the hotels and lodging houses for the rich, as we do those for the poor, under police control. In some towns in Germany and Switzerland, the hotel keepers are obliged to report zymotic cases to the police authorities; and within the last few months a patient whom I had sent to travel for health in Switzerland, and who was attacked by small-pox, was removed by order of the police to the public hospital at Zurich—was admirably cared for in a private ward, and, I have little doubt, enjoyed greater advantages than in the hotel. Whatever difficulty may occur in meeting the spread of contagious diseases in lodging houses and hotels, there ought to exist none in the case of using public vehicles for the transmission of infectious cases. This, I regret to state, is a practice constantly adopted in this city—adopted as a matter of necessity—as, unless for the Cork-street and Hardwick Fever Hospitals, there is no vehicle attached, as there should be, to the hospitals, and the only alternative left is using the public conveyances. I think it my duty to call the attention of those whom it may concern to the correction of this fruitful means of disseminating disease, merely premising that until the governors of hospitals provide ambulances, or other suitable conveyances, it is needless that the police prohibit the practice referred to.

SMALL POX.

The wise step taken at last by our legislature in rendering compulsory the practice of vaccination, having broken the ice of that frigid and mistaken axiom of "not interfering with the rights of the subject," even to save his life, we may hope to see other sanitary measures of a compulsory nature to follow in its wake. Rights of the subject! Is small pox a right of the subject? I ask you as enlightened men, and, I doubt not, members of the community sturdy for your rights, whether our legislators best consulted your interests by maintaining for you in all its integrity the right of having small-pox, or by yielding ungraciously to the importunity with which we for many years tortured them into an acquiescence in the Compulsory Vaccination Act? And, although we could have modified the Act in some respects, I speak the

opinion of my brother directors of the Cow-pock Institution when I state that we look forward with confidence to this measure, when long enough in operation, as a means of exterminating small-pox, unless when imported. There is strong reason to suppose that its recent appearance in Dublin was due to this cause, as it was traced to the arrival of a regiment from an infected district. Its occurrence in this way seems to be one of those exceptions that prove a rule. The great Jenner himself anticipated this in his letter to Sir Charles Morgan, in 1811. "The small-pox (he says), if it now and then seizes upon some deluded infidel, soon dies away for want of more prey." I am happy to add, his views are in the present likely to prove as true as in former attacks, as the disease appears again "dying out for want of more prey." Attention to ventilation and sewage in the lodgings of the poor, and the non-transmission through our public vehicles, will further assist its extinction.

VENTILATION.

We have been hitherto dealing with the exclusion of foul air from our breathing atmosphere. But the atmosphere is not merely vitiated by sewage exhalations. The constitution of man himself is such, that his presence necessarily poisons or vitiates the atmosphere in which he exists. The due performance of the functions of breathing and exhalation from his surface abstracts from the atmosphere certain of its constituents, and imparts to it other qualities that render a given portion of the atmosphere, if stagnant or shut off from fresh supplies, ultimately incompatible with human life; man may thus be said to perpetrate the suicidal paradox of self-murder by persisting in living. In the construction of our new, and in the arrangements of our old houses, then, we must look to it that a sufficient provision is made for changing the air we breathe; in other words, for allowing of the escape of the vitiated, and admitting of the entrance of pure air.

It has been remarked that fireplaces and chimneys are meant to secure heat, windows light, and doors approach to our rooms; but that there is no provision for ventilation. Fortunately for us, this axiom, although well intended, is not true, as were it not for the doors and windows and chimneys, our breathing process would long since have ceased. The fact is, that the arrangements we have been obliged to make for heat, light, and access to our chambers, have hitherto, although lamely, supplied us with a make-shift ventilation, thus causing this important subject to be overlooked; and I regret to add, that I daily see modern houses constructed without proper attention to this matter; nay, the architects and builders are even quite alive to the necessity of ventilating the *materials* of which the house is built, but as to the occupiers, this does not enter into their philosophy. Witness the ventilating gratings to admit the air to the rafters, and louvres to admit it to the roof, whilst the smallest quantity of fresh air is religiously excluded from the human props of the house, and *that* where life depends upon a good supply of it. Before presuming to bring this subject under your notice, I may mention that I seized with avidity one of the most

recent, and I believe popular, books on house architecture. It is a large octavo, filled with most elaborate drawings and plans, and containing no less than 484 pages of exuberant letter-press, of which *two* were devoted to the discussion of the sanitary arrangements!

Every occupied room, whether for rich or poor, young or old, sick or healthy, for man, animal, or plant, ought to have provision made for a constant atmospheric change; this is best done by an arrangement expressly directed to that object. For this purpose there should be two special openings—one always placed in the highest level of the chamber for the escape of the heated and vitiated air, the other in the most convenient part of the room for the admission of pure, which is usually colder, air. Both of these openings ought to communicate by means of closed chambers or tubes with the external atmosphere—*that* for the *admission* of air directly, *that* for the escape may pass into other chambers, such as a chimney or an unoccupied louvred attic; the direct communication is, however, far preferable where it can be accomplished. Arnott's very ingenious ventilator is adapted to the latter purpose, and is usually inserted into the chimney near the ceiling, upon the principle that the air in the chimney, being at a higher temperature, adds to the exhausting effects by drawing out the heated air in the elevated part of the rooms.

The different opinions held upon Arnott's ventilator have rendered it a species of paradox in the *science*, as it has proved a puzzle in the *practice* of ventilation—as, although it answers admirably in some cases, in others it does not act at all; or is even subject to a blow down, admitting smoke, and disfiguring the room. I believe the explanation to be this:—In those grates in which the draught is confined, or narrowed *below*, as in Sylvester's grates, the action of the ventilator *above* in the chimney is necessarily increased, consequently it acts with precision. On the contrary, in the ordinary registered grates, where the draught is much more open, the exhaustion of the air through the ventilator amounts to nothing, and even admits of a blow down occasionally. The down currents of cold air in the corners of our square chimneys may further explain the occasional failure of Arnott's ventilator.

The simplest manner of making the exit tube is by leaving a shaft in one of the walls communicating with the ceiling of every chamber in the house, and running up to the roof in the chimney stack. I have adopted this plan in some lodging houses which I lately built for the poorer classes; it is inexpensive, and answers the purpose very well. Miss Nightingale recommends a similar plan. The same object is easily accomplished in the bedrooms of the rich and dwelling rooms of the poor on the plan recommended by Dr. Collins, in a scheme for ventilation laid down by him in a paper read some years ago. He advised that wooden tubes should be run up in the angles of the walls, from the ceiling to the roof. Of course, the size of the tube may vary according to the number of occupants; for a room of twenty feet by fourteen, four inches square would answer. A blow down rarely occurs from

this, if led to the roof at some distance; but if it should, a louvred adaptation must be made above, and a screen below if necessary. In case of larger tubes, when ventilation is required on a greater scale, as in hospitals and public buildings, the outlet above must be roofed and louvred, and even a traversing cap may be necessary to prevent down currents in changing winds. In the reception rooms, and particularly in the dining rooms of the better classes, where elegance is as well to be considered as health, the best and least objectionable plan for the exit tube is to place it over the gasalier, lustre, or lamp in the centre of the room. This plan I have adopted in my dining room; the fitting, which is inexpensive, was prepared by Mr. Daniel, of Mary-street. It fully exhausts a room of about twenty-eight by twenty feet, occupied by twenty-four people, and by eight No. 4 fish-tail gas burners, burning four cubic feet of gas per hour, with a pressure of seven-tenths. Having first removed the old solid centre piece, and procured a crenelated centre piece of two feet six inches in diameter, the ceiling was removed to the extent of two feet to admit of fitting two half-funnel-shaped vessels of zinc, such as I exhibit. These are, as you see, open below, and terminate above in two zinc tubes two inches by two each. These tubes run, one at either side of the rafter, underneath the floor of the drawing room, rising about one in thirty until they reach the wall. They then unite in one zinc tube equal to the diameter of both, which runs upwards behind the drawing room skirting, and penetrates the outside wall. It here passes upwards perpendicularly for about four feet, when it opens under an extinguisher-shaped roof raised about four inches from and projecting about two inches beyond the funnel. The gas, which is thus consumed immediately below the funnels, in place of loading the atmosphere with offensive matter, is of great value in securing the proper ventilation of the room. The air, heated by combustion, rises rapidly to the funnel, and rushes along it, effecting that which is most difficult to accomplish in all ventilation—the certain and speedy removal of the vitiated air from the room. I must endeavour, before leaving this branch of the subject, to impress upon you that the fire chimney is not to be relied upon for the exit of vitiated air. Daniels' experiment, in which he proved that the watery vapour emanating from eight people continued to charge the atmosphere until the point of condensation reached 52° from 39°, where the air escape was restricted to an open chimney, is conclusive upon this point.

To supply fresh air in place of that so removed, the simplest plan is to make a direct communication with the external atmosphere, but of somewhat larger dimensions than the exit tube, as the fire chimney also carries off a large supply of air from the room. *We* prefer taking our supply direct from the outer atmosphere. Many comfortably disposed people might prefer taking their supply from the heated air in the passages or other rooms of the house: were we satisfied that the air in the passages was not vitiated, the same objection would not hold to this plan. An instance of this faulty arrangement upon a large scale came

under my notice some years since, when my friend Dr. Corrigan and I were directed to inquire into the cause of the mortality of the infants in the North Dublin Union Workhouse. We there found the infant day room occupied by some hundreds of children (to whom pure air was of the most vital importance), supplied by means of several borrowed communications, by the air that had already permeated the lungs of the occupants of the adult day room, and *vice versâ.*

It is, therefore, safer to admit the air direct into our sitting rooms, as well as our bed rooms—but, above all, to secure this being done into the dwelling rooms of the poor.

In my lodging houses I have adopted the plan of simply inserting two perforated bricks close to the ceiling, one on a level with the inner, the other with the outer surface of the wall, and with a communicating chamber. This secures double currents, so as to heat the stream of air on entering, and thus lessen the draught. It has further the advantage of being inexpensive, always in operation, and cannot be put out of order.

In my own dining room I prefer retaining the power of moderating the quantity of air admitted, according to the number of occupants, and I have two apertures of four inches by eight communicating directly with the outer air, but fitted with perforated zinc plates, which reduces the measurement to about $3\frac{1}{4}$ by $3\frac{1}{8}$—or, say eleven superficial inches each—with sliding doors so adapted that a greater or less supply can be admitted, or the supply altogether shut off. Where it is an object to render the supply uninterrupted, it is better, for several reasons, to place these apertures on a level with the ceiling, and this further secures a more complete circulation of air, and warms the air before impinging upon us. The cold air on entering the room, by its greater gravity, gradually approaches the floor, adopting certain curves, depending upon prevailing currents, and then, when heated, reascends. Thus a double circulation is secured. The having the apertures below certainly renders them more within reach for regulating them, although, on the other hand, it brings the air in its lowest state of temperature in contact with the person of the occupant, and particularly with the feet; whilst, for the purposes of health, it is rather an object to keep the feet warm, and the head cool. On the whole, then, I think it safer to open the supply air tubes on the high level, and to adapt a lever, so as to regulate them in that position; this adds but little to the expense. Where the contrary plan is adopted, the opening can be made behind the window curtains, and thus a more gradual diffusion with the heated air of the room secured. Mr. Louch, of this city, in his excellent pamphlet on ventilation, recommends a ventilator with several perforated zinc plates in place of the two above-mentioned, with a view to restrain the currents and heat the air on its entrance, taking the hint from the respirator. Mackinnell has constructed a ventilator of an outer and inner tube; the first admits the ingress, the latter the egress of the air.

Ventilators are sometimes attached to the windows. Cooke's ven-

tilator is fixed to the top of the window, made of copper gauze, in two planes, placed at an angle of 45°; the heated air escapes at the upper plane, and the cold enters at the lower. Mr. Green, of this city, has invented one of a semicircular shape, which is stationary, and also of wire gauze. Cooke's moves with the window sash, and is only in operation when a portion of the window is open. Sherringham's ventilator is an ingenious contrivance, constructed with a view to prevent the blow down.

In default of ventilators, windows should be made to open from the top. When this cannot be done, the lower sash may be thrown up about three inches, and a piece of moveable board fitted into the interspace between the lower part of sash and frame. This secures a safer supply of air above between the sashes, which blows upwards, instead of blowing directly on the occupants.

VENTILATION OF CHURCHES AND PUBLIC BUILDINGS.

In a sanitary point of view, the subject of house ventilation would be quite incomplete, did we not draw attention to the necessity of improved ventilation in our churches and public assembly rooms, as whatever care we may adopt within our houses will prove inadequate to prevent the evils resulting to us from this neglect, unless *their* state be attended to also. These buildings, being required merely for temporary purposes, are never constructed with reference to the number of occupants crowded into them. Did we give 1000 cubic feet of atmospheric air to every occupant of a church, concert room, or aggregate meeting room, these rooms would assume an expansile extent totally impracticable. It the more behoves us, then, to provide in these for a rapid, constant, and certain change of atmosphere, in doing which we must recollect that each person in the church vitiates a gallon or three hundred cubic inches of air each minute he remains there. But do we find that a provision is made for this to be the case? Who that walks into one of our popular churches, with its closely packed crowd of human occupants, can fail to be struck with the stolid indifference pourtrayed in the listless, relaxed attitude and sleepy stupor of the mass of the congregation, despite the efforts of the pulpit orator, aided by a resounding voice and athletic arm, to arouse their consciousness? The fact is, that the congregation is much in the same state as if it were breathing in a charcoal-poisoned chamber, or under the influence of chloroform. The occupant, in addition to stupor, experiences a sensation of cold in his extremities from remora, or retarded circulation, and his inhaling carbonic acid gas instead of oxygen. Let the inquirer look up, and he will either find the ceiling without ventilators, or, as is not unfrequent, the ventilators carefully battened down with two-inch plank, lest a blow down should elicit a sneeze from the churchwarden or the sexton. Let him endeavour to look across the church, and he will find the atmosphere so charged, that he cannot recognise objects with which he is familiar at the usual distance; but, above all, let him look to the walls

f the building, and if these have been coated, as they often are, with il paint, he will detect trickling streams, running into small rivers, ervading them throughout, and often washing down upon the wall, eats, or floors of the galleries. What, let us ask ourselves, are these rivers? The human exhalations thrown off by the lungs and the cutaneous surfaces of the congregation, which have thus surcharged the atmosphere, and which, on coming in contact with the cold walls, have become condensed into the purling streams described. It is too offensive to contemplate the excrementitious accumulations resulting from the number of times each particle of air thus breathed must have traversed the lungs and impinged upon the skin of the various members of the congregation before becoming thus loaded. But this is not all; the congregation separate, and the windows are kept carefully closed to have the church comfortable for evening service; the congregation reassemble, the process recommenees—but, as the evening congregation is not generally so large, the deficiency of supply in the generation of animal exhalations is compensated by the evaporation from the walls, and so the supply goes on.

How is all this to be prevented? First, by securing a proper system of ventilation on the principle already insisted upon, only taking care that the supply and exhaustion of the atmosphere bear a proper relation to the number of the congregation, and that this be done without causing dangerous currents of cold air; and, secondly, as with every precaution that can be safely adopted, the likelihood is, the atmosphere will be loaded at the conclusion of each service, let the windows and doors of the church be one and all thrown open the moment the church is evacuated, and the fires kept alight for the whole of the Sunday, beginning at six o'clock in the morning, and keeping the windows and doors open until shortly before morning service commences. It is of much more importance to the congregation that the fires be lighted before and after, than during the service, in a sanitary point of view. In a public room merely occupied at intervals, it is better that the walls should be finished in distemper, or, better still, in lime wash, than in oils. In the former cases they act as an extensive sponge, absorbing the fluid exhalations, which, by proper ventilation and heating, should be dried out before its next occupation, and the poisonous carbonic acid permeates them, which it does not in the oil-painted walls; whereas in the latter the vapoury exhalations are immediately converted into fluid, and, when re-evaporated by the heat of the atmosphere, are reintroduced into the lungs of the occupants. In recommending distemper colouring, I should however advise that size and soap be omitted, merely using whiting or lime wash with tints of colour to please the eye, as the idea of inhaling the parasitic organisms generated in size or other animal matter is offensive.

Ventilation should, then, be freely introduced into churches and public buildings on the same principle as in our houses, both to secure the entrance and escape of the air. These, although combined with

advantage with our heating apparatus, should not depend upon this, as in summer, when the air is stagnant, we do not use artificial heat; we shall, however, recur to this matter in connexion with heat; but I cannot close our observations on ventilation better than by reminding you of the important proof of its efficacy established by a fellow-citizen of yours, the late Dr. Joseph Clarke, who, by improvements introduced into the ventilation of the great Lying-in Hospital at the end of the last century, reduced the mortality amongst the infants born there from 1 in 6 to 1 in 104.

HEAT.

In all our sanitary arrangements, both within and without our homes, it becomes an object with us to maintain the human body at an equable temperature. This is done by elevating the temperature of the atmosphere in cold climates, and reducing it in warm climates, to a degree compatible with health and comfort, and by the adaptation of some artificial covering to the body that accomplishes the same objects without impeding our motions. This, then, brings us to the consideration of the means of heating and cooling our houses, and the best means of clothing ourselves. The first matter to bear in mind is the tendency in all substances coming in contact to equalize their temperature—that is, for bodies warmer to impart a sufficient amount of heat to colder bodies, or to bring both on a par. Some bodies do this more rapidly, others more slowly; the former are termed good conductors, the latter bad conductors of heat. Now, this is a distinction that we must never lose sight of in dealing with our present subject.

In cold or temperate climates, such as ours in the winter season, our energies are directed to elevating the temperature of the air within our houses; and, to do this effectually, we must isolate our house from the surrounding atmosphere. If this has not been sufficiently attended to in its erection, the difficulty is afterwards much increased, and often nearly insuperable. The selection of a porous subsoil in our building site, the thickness of the walls, the nature of the materials used in building, the placing the houses in an elevated situation, but with protection from prevailing winds, the avoiding too close proximity of trees that cause damp, the interposing a good mass of atmosphere between the ceiling and the roof, the having a basement story, and, above all, the having the carpentry of the windows and doors complete in its fittings, which can only be the case if seasoned timber is used in their construction—are all matters which, if not carefully attended to in the construction of the house, can rarely be afterwards remedied. We shall suppose that, as far as practicable, the above requirements have been carried into effect; still we must have communication with the external atmosphere, and even if we had none, the process of giving off heat through the walls, roof, and floor, would go on until an approximate equalization would occur between the air within and without the house. To elevate the temperature, we must therefore generate arti-

ficial heat within the house, and, as far as possible, prevent its abstraction. The generation of heat is produced by combustion, and our choice of combustible materials is limited to four—wood, peat, coal, and gas. Wood and peat are so rapidly consumed, that, except to those living in a forest or a turf bog, where labour is cheap and water and railroad carriage are unattainable, coal is the most economical fuel. It also possesses the advantage of eliminating a much larger amount of heat by the combustion of a given quantity, and of requiring a much longer time to consume. Gas, unless where heat is required only for temporary purposes and on a small scale, is not much used for the purpose of heating, because it is not considered an economical, although it is a very simple, speedy, and elegant way of generating heat for domestic purposes. For ordinary purposes, where a temporary heat is required, it is doubtful whether we are right in our idea of gas being more expensive. Soyer, who was a culinary contractor on a large scale, used it for the purposes of cookery.

GRATES AND STOVES.

In Britain, where coal is plenty, we adhere generally to the primitive system of burning our fuel in open fireplaces, with chimneys to carry off the smoke or unconsumed carbon. On the Continent, where fuel is scarce, and wood or charcoal in more general use, the stove is more common. There can be no question that of these two the open fireplace is the more wholesome, and safer to the inhabitants of the house; because, while the unconsumed products of combustion are removed, the air in the apartment is not burned by contact with the metal; and, second, because the process of ventilation, which is seldom otherwise provided for, is best secured by an open chimney. On the other hand, however, there is a much greater loss of caloric in the open chimney, and consequently a greater consumption of fuel in obtaining the same elevation of temperature. Much has been done in our improved kitchen ranges to meet this objection and economize the caloric, by making the same fire perform several culinary operations at the same moment. A certain amount of fallacy exists in carrying this principle out to extremes; as, however we may economize the caloric developed and direct it into ingeniously devised chambers, imparting heat to articles of food contained in each, it is a self-evident fact that every particle of caloric imparted must be rendered by the fuel submitted to combustion, and of course fuel must be consumed in a direct ratio to the heat imparted. In other words, in a kitchen range performing a number of operations, coal must be heaped on in proportion to that number.

It should be recollected that heat radiates in every direction, consequently the grate should be elevated sufficiently from the hearth to give to the chamber the benefit of its radiations *downwards*. It is also to be so constructed as to give the effect of its lateral radiation, and, if possible, its radiation backwards and upwards should be preserved.

Now, in our ordinary grates these points are completely lost sight of, the consequence of which is, that we generally lose all the radiation upwards and backwards, and retain little or none of the heat radiated downwards and laterally, obtaining merely the radiation forwards. In the construction of our flues, to secure a proper amount of exhaustion, as extremes are pernicious, the smoke tube or chimney should be of proper form. The higher, of course, the greater draught, but its form is also a matter of consideration; hitherto it has been square, but the practice latterly has been to construct chimneys of a cylindrical shape to lessen the accumulation of soot, and because smoke in the mass assumes a cylindrical form. Now, although the volume of ascending smoke has a tendency to assume this form in its issue from the square chimneys, it must be recollected that the corners of square chimneys admit of enough of downward current to facilitate the upward circulation. In calculating the diameter, it should be borne in mind that a cylinder of twelve inches diameter is only equal to a square of nine. These considerations may explain why earthenware cylindrical chimneys become so sensitive and liable to blow down on changes in the force of the wind. Another principle that should not be lost sight of is this, the relation that ought to exist between the point of access of the air at the fire and the outlet at the top of the chimney. The latter should exceed the former by about one-third.

The approximation of the fuel under combustion to the entrance of the chimney influences the draught greatly. Combustion can only be sustained by the contact of atmospheric air; and where it is an object to increase this, we must recollect that at the posterior part of our fires little or no combustion exists. To meet this difficulty, perforated metallic backs have been placed to grates. But if there be no radiation backwards, this additional consumption of coal is lost, as the caloric disengaged behind will in all likelihood radiate upwards to the chimney.

Having premised that the objects to be desired in selecting grates are, complete combustion, large radiation into our chambers, certain draught, ventilation, and facility of approach to the flue, we shall best explain how these objects are to be accomplished by exhibiting a few grates in which these points have been more or less completely carried out, dwelling upon the merits and demerits of each as we proceed. It must be borne in mind that the more of these requirements a grate possesses, the more perfect it is. Sylvester's grate possesses hearth, plate, and supply tubes. It is splayed with polished metallic planes, but the communication between the flue and grate is too narrow. It radiates a large amount of the heat generated, and this raises the temperature of the room very high, yet it renders the atmosphere stagnant, and is consequently a bad ventilator.

Stevens' patent—a grate half circular in its form, and with a flat steel ashpan; it radiates largely, and has an increased draught, and is therefore a very good grate.

Bashford's disc—the form and reflecting power of this grate are such that it radiates the greatest amount of heat—indeed, some might imagine too much. It is particularly suited on this account to the end of a long room where there is but one fireplace. The objection as to ventilation is got over by a more open communication with the flue. But the draught in it is very great, like Sylvester's grate, from the approximation of the flue to the fire. This difficulty is compensated for, however, by having its front moveable on rollers and hinges, so that ventilation can be amply secured, or the grate cleaned, by drawing the patent front out.

Wright's bivalve is the nearest thing to perfection in outline and action, and radiates admirably. Its ventilation, however, is not so perfect, although this also is improved by the introduction of a second valve to lessen the intensity of the draught. The objections to Stevens' patent have been obviated in this grate by enlarging the valves and rendering the front moveable, as in Bashford's disc grate, in order to afford the power of cleaning and increasing ventilation.

King's patent possesses the greatest advantage of any grate yet constructed of retaining the heat in the chamber, its construction preventing the escape of the slightest quantity of the atmosphere, unless that occupied in securing combustion. It, however, possesses the greatest disadvantage in ventilation, and is little better than an inverted stove. It may here be mentioned that Arnott's ventilator, by its action or failure, is not a bad test of the ventilating powers of a grate.

On lighting a fire or stove in the hall or central passage of a house on the ground floor, the heated atmosphere rises, and pervades every passage and room in the house, rendering unnecessary large fires in the rooms, because the air in the passage does not abstract their heat. It maintains, consequently, an equable temperature through the house. Much has lately been said about keeping the windows of our bedrooms open at night, winter and summer. This may be done in summer, taking care to screen the direct draught of air from the part of the room occupied; but in the winter it can seldom be done with impunity in this climate.

It should be recollected that the top rooms are the coldest in winter, and the hottest in summer, from the more rapid radiation of heat in the former, and the more rapid and direct absorption of heat in the latter. This is always more markedly the case when the mere rendered roof forms part of the ceiling without any intervening air chamber, and when the roof is covered with dark-coloured slates. When inconvenience arises from cold in attics, they are rendered much warmer by a counter or false ceiling enclosing an inter-space of atmospheric air, which is a bad conductor.

The ventilation of our churches and public buildings is usually combined with a different plan of procuring heat from that in our houses. Latterly stoves have been substituted for open fireplaces, which deprives us of the assistance they rendered as an additional

means of ventilation. The ordinary stove for churches with descending flues is so arranged to prevent the unsightly appearance of a funnel running up the centre of the church. This is a species of furnace which merely admits air enough to secure the combustion of the fuel, and the draught is obtained by exhausting the air in the chimney by means of a second fire in a separate chamber placed on a lower level.

Of late years the practice of heating churches, public buildings, and mansions, has been much carried out by first elevating the temperature of water or air, and then conducting this heated fluid through the house, which, on its passage, imparts caloric to the atmosphere. There are various plans in operation to effect this purpose; their promoters insisting upon the more certain, the more equable, and some even have it the more economical, diffusion of heat secured by them. Heated air has long been in use in our hothouses; but in them, as in our dwellings, the objection of burning or drying the atmosphere has been so proverbial, that the evaporation of water artificially to re-supply the moisture of the atmosphere is practically necessary. Warm water heating is not liable to this objection to the same extent; but those who have frequented houses thus heated are rarely so satisfied with the atmosphere as with that heated by open fireplaces. Besides, the tendency in most of these secondary plans of heating is to elevate the temperature too much—a circumstance injurious to the health of the occupants, as rendering them more liable to the deleterious effects of sudden exposure to a reduced temperature. The effect of stepping out of these houses is much the same as that experienced by our imprudent countrymen, who dally ont of doors in the South of France at the moment of the sun's sinking below the horizon. Another plan still is occasionally adopted for heating—namely, rendering the chamber heated a portion of a flue or chimney, no air being allowed into the chamber which has not traversed a heated air chamber, or passed over the surface of heated iron plates. I here exhibit diagrams of Perkins' plan for heating and ventilating the Justiciary Court, Edinburgh, and of Cardell's warming and ventilating arrangement for bookbinders' rooms; also of the Belpar stove for generating a large amount of heat, kindly furnished me by Professor Shaw, of Trinity College, and shall subjoin his table, slightly modified, on

Smoky Chimneys.

CAUSES.	REMEDIES.
1. Want of air for fire.	Diminish lower orifice of chimney; increase the supply of air.
2. Fireplace too large.	Diminish at the sides, and above.
3. Chimney too short.	Raise up and contract the fireplace.
4. Interfering fires.	Supply air enough to each apartment, and detach.
5. Flues common to different apartments.	Guiding plate in flue, and traps for empty fireplaces.
6. Action of sun and wind, &c.	Adapt suitable screen, pots, and hoods.

The exhaustion of the heated air may be secured by a gasalier communicating with the roof, as we find in the Bethesda Chapel; or the fire may be placed in a distinct chimney, as was done by my friend the late Dr. David Boswell Reade in the Houses of Parliament. The currents of air in rooms still require much elucidation, and may be described as direct, retrograde, and irregularly circular in a chamber heated with one fireplace, and a ventilator over the chimney and window. Dr. Mapother gives the diagram I now exhibit, showing the circular transit of a gas balloon floating loose in an atmosphere of equal specific gravity. I cannot refer to this gentleman's lectures on public health, delivered at the College of Surgeons, without expressing my strong sense of the talent and information they display, and recommending them to your perusal.

CLOTHES.

Our subject would be incomplete, did we not consider briefly the means of sustaining the temperature of the body without our houses, and make a few observations about clothes. There is nothing upon which greater misapprehension exists in the popular mind. Clothes do not, as we imagine, convey heat; they merely prevent the abstraction of our internally generated heat, or perform the same office for us that the walls and roof of a house do. The human body possesses a power of generating heat through a process in some respects resembling combustion, and of retaining the temperature at about 98° of heat, whether the thermometer stands at zero or at 120 without the body. This regulating power we explain, as we do many other phenomena beyond our reach, by the use of a convertible term, and call it vital. By this vital heat-generating power, however, the human body is not removed from the influence of general physical laws when carried to extremes or long continued. And it is quite possible to roast and freeze it, despite the vital laws alluded to. It is equally possible, without proceeding to these lengths, to produce influences upon it through the application of heat, and by the want of heat, that prove highly injurious to its healthy functions. To prevent these injurious effects, clothes are worn; and strange as it may appear, clothes are used equally in cold climates to retain the natural heat, and in warm climates to isolate the body from the surrounding highly elevated atmosphere and the burning rays of the tropical sun. The old lady with her wrap of shawls and fur-lined hood, wending her way to her whist party in St. Petersburgh, on a December night, has a strange counterpart in the gallant young European officer, mounted on his Arab, with his head enveloped in turbaned shawls six inches deep, traversing the plains of Hindostan under a burning sun in the month of June; yet both are practical philosophers, despite the blow-hot, blow-cold objection. The experienced Russian matron is resisting a rheumatic attack by interposing a bad conductor between her head and the freezing atmosphere without, and thus preventing abstraction of her internal heat. The gallant Anglo-Indian is warding off a

sun-stroke by interposing a bad conductor between his head and the scorching atmosphere and burning rays of the sun without.

In selecting clothes for a cold climate, then, as for a hot one, we approve of them in an inverse ratio to their conducting powers, and may place the textures generally used in the following order:—*Wool, Cotton, Silk, Linen*. In addition to the fact of its worse conducting powers, wool, by the friction it produces, assists in keeping up the temperature. This points it out as particularly suitable for cold climates; again, its powers of absorption, and, when charged with moisture, its worse conducting powers, causing it to abstract less heat, contrary to what is the case in a marked degree with linen, and in a lesser degree with cotton and silk, render it equally the most suitable texture in tropical climates. Woollen textures hold a larger quantity of atmospheric air within their meshes, which further adds to their non-conducting agency. The form or shape of our clothes is also a matter of some importance. We have already mentioned that atmospheric air is a bad conductor of heat; consequently, when our clothes are made loose and flowing, a quantity of atmospheric air is enclosed between the clothes and the person. This assists the clothes in preventing the abstraction of heat, rendering loosely fitting garments warmer in cold climates, and cooler in hot climates. These loosely fitting garments our police, as well as our military authorities, have wisely adopted.

It is a great mistake with parents to fancy that they serve their children by insufficiently clothing them, in order to make them hardy, in climates requiring the extremes of heat and cold to be moderated. The idea is unnatural—it is unphilosophical, and the practice is mischievous. Boys, whilst they take plenty of active exercise in the open air, may escape when lightly clad in very cold weather, because increased heat is generated by their exertions; but the moment they become passive, they are in the position of a hothouse plant, suddenly placed in the open air with the frost on the ground.

Felt, which is a very close texture, produced by the interlacing of the covering of certain animals, due to a serrated provision which it possesses, but which is not visible to the naked eye, is a valuable addition to our clothing, and ranks with wool as a non-conductor. It is not pliant, however, and consequently is reserved for clothing those parts of the body in which pliancy is not so much an object as resistance and impermeability; this explains its adoption in our hats, as well as back or neck clothing in warm climates, where there is much exposure to the sun's rays.

The present form of our hats I confess myself at a loss to account for upon any principle of reason, philosophy, or elegance! But, as the tendency is to ventilate them, we may possibly arrive at some explanation of it!

The colour of our clothes is so far a matter of consideration, that light colours possess the property of reflecting the sun's rays, whereas dark colours absorb them. The former, therefore, are more suitable to

summer and to tropical climates, and the latter to our winter and cold climates. We shall not dwell upon the refinements of selection of colour, as fashion and taste will scarcely tarry for our guidance in such matters.

Although obliged to place linen as the best conductor, I should be sorry to be supposed so unpatriotic as to condemn its use : as an article for outer or intermediate clothing, our objection does not hold; and for summer wear and durability, no texture can exceed it in usefulness, as, from the perfection to which it is daily arriving, it may eventually excel cotton fabrics in beauty. Here are some specimens of Irish linen that bid fair to supersede cotton.

The first step was getting the mill-spun linen yarns, which rendered it more even, and better colour; consequently, required less time for bleaching, and gave more rapid return for capital. Power looms are now being introduced, which render the linens less expensive. They are now as cheap as the French printed cotton fabrics, and wear infinitely longer.

RESULTS OF ATTENTION TO SANITARY IMPROVEMENTS.

But it will be asked, what have you gained by attention to these sanitary improvements insisted upon? It is with no small pride I can answer that, without referring to Howard's opinion of the Dublin prisons, I can point to instances of progress in this direction in our own city when matters were at a low ebb elsewhere. I have already drawn your attention to the fact of Dr. Clarke's reduction of the infant mortality in the Lying-in Hospital from 1 in 6 to 1 in 104, 19-20ths of whom died from infantile convulsions. I have now to add that, by Dr. Collins's improvements in ventilation, this mortality was still further reduced to 1 in 666. This astonishing saving of human life, amounting to upwards of 600 per cent., was promulgated in Dr. Collins's admirable paper "On the Prevention of Contagious Diseases in the Homes of the Poor," read from the Chair of the College of Physicians in February, 1848. Another instance was the reduced mortality in the Protestant Orphan Society of Dublin, which since the orphans were boarded in the county of Wicklow only amounts to one per cent. I need only contrast this with the mortality of the pauper infants of the London workhouses in the last century, who died at the rate of twenty-three out of twenty-four within their first year. I shall not do more than refer to the tables furnished by us of the mortality of the foundlings of this city at a much later period, as it is unpleasant ripping up a reminiscence so disgraceful to our common humanity. Looking at these results, and many others that I could adduce did time permit, do the opinions of those who affirm that man's average age, under proper management should approach to eighty, seem so preposterous? Do the results of our exertions hitherto justify our persistence in the efforts recommended? I answer—the average life of man in England, or death age, as it is termed, is now forty-six; that, honour to the exertions of

the late Lord Herbert and Lord Shaftesbury, the death rate in the British army at home, which averaged 17·5 in 1000, is decreased to $8\frac{1}{2}$; whilst at Aldershott and Shorncliffe, through the exertions of Miss Nightingale and others, it has fallen to 4·7 in 1000. The improvement in the sanitary condition of the barracks by ventilation and otherwise, gave the following results in the death rate of the different branches of the service:—

Average of ten Years.

	1837.	1840.	In	1860.
Infantry Regiments, ...	17,	9,	To	7·6 in 4000
Foot Guards, ...	20,	4,	"	9·1 "
Royal Artillery, ...	13,	9,	"	8·0 "
Dragoon Regiments, ...	13,	6,	"	8·0 "

It should be mentioned that 1000 cubic feet of atmosphere form now the minimum allowance in the military hospitals.

The same Divine authority that asks, "What man is he that liveth and shall not see death?" hath also said, "The days of our years are threescore years and ten." This at least should constitute our standard to aim at for every other man, as most of us calculate upon it, however unwittingly, for ourselves.

It now only remains to say one word in apology for this paper.

Without assumption, I might claim the power of being able to display more learning in it, had that been my object. I might have grappled with the cloaca-maniaists (from whom, I honestly admit, I have begged the question), and rendered it even sensational, had I so desired. But the task I pointed out to myself was more practical—namely, to enunciate in language intelligible to every householder those neglects in the every-day management of our homes and families with which my opportunities had long rendered me but too familiar. I now hand it over to your tender mercies, and doubt not, from the time occupied in its discussion, there are many sages amongst my hearers ready to apply the language of the poet:—

"'All this is madness!' cries a sober sage.

But who, my friend, has reason in his rage?

The ruling passion, be it what it will,
The ruling passion conquers reason still.

"Less mad the wildest whimsy we can frame,
Than even that passion, if it has no aim;
For, though such motives folly you may call,
The folly's greater to have none at all."

XXXVIII.—*Return of Donations to the Royal Dublin Society.*

THE LIBRARY.

THE LORDS COMMISSIONERS OF THE ADMIRALTY.

Airy (George Biddell, Esq., M. A., Astronomer Royal). Astronomical Observations made at . . . Greenwich in the Year 1862 . . . Part 1. 4to. *London*, 1864

THE ASTRONOMER ROYAL, ROYAL OBSERVATORY, GREENWICH.

Airy (George Biddell, Esq., Astronomer Royal). Essays on the Invasion by Julius Cæsar; . . by Plautius, and by Claudius Cæsar; Military Policy of the Romans . . .; the Battle of Hastings. . . . Printed for Private Distribution. 4to. *London*, 1865

THE AUTHOR.

Alanus (Henr.). Observationes in loca aliquot Ciceronis. Accedunt in Cæsarem, Frontonem, Gallium, Plinium nonnulla. 8vo. *Dublinii*, 1864

THE AUTHOR.

Alanus (Henr.). Observationes in Q. Curtium Rufum. . . . 12mo. *Dublinii*, 1865

THE AUTHOR.

Alanus (Henr.). Hannibal; sive Disputatio qua id agitur, ut Summus ille Pœnorum Imperator contra Criminationes quasdam T. Livii defensus detur. . . . 12mo. *Dublinii*, 1865

THE NATIONAL ACADEMY OF SCIENCES, WASHINGTON, U. S. A.

Annual of the National Academy of Sciences for 1863–1864. 8vo. *Cambridge* [*Mass.*], 1865

THE AUTHOR.

Belcher (T. W., M. D., Dublin; . . . .). Memoir of John Stearne, M. & J. U. D., S. F. T. C. D., Founder and First President of the College of Physicians; including the original Charter. . . . 8vo. *Dublin*, 1865

THE SECRETARY OF THE INSTITUTION OF CIVIL ENGINEERS.

Braithwaite (Frederick, M. Inst. C. E.). On the Rise and Fall of the River Wandle; . . . . Edited by *Charles Manby*, F. R. S., M. Inst. C. E., and John *Forrest*, Assoc. Inst. C. E. 8vo. *London*, 1862

THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (by John Herbert Orpen, Esq., LL. D., Local Treasurer).

British Association for the Advancement of Science; Report of the Thirty-fourth Meeting, held at Bath, in September, 1864. 8vo. *London*, 1865

THE ROYAL ACADEMY OF SCIENCE, MUNICH.

Buhl (Dr. J. . . .). Ueber die Stellung und Bedentung der Pathologischen Anatomie. .. . 4to. *München*, 1863

THE AMERICAN PHILOSOPHICAL SOCIETY, HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE (by J. P. Lesley, Sec.).

Catalogue of the American Philosophical Society Library. Part 1. 8vo. *Philadelphia*, 1863

BRYAN H. HODGSON, ESQ., DURSLEY, GLOUCESTERSHIRE.

Catalogue of the Specimens and Drawings of Mammalia, Birds, Reptiles, and Fishes of Nepal, Sikim, and Thibet, presented by B. H. *Hodgson*, Esq., to the British Museum. Second Edition. 8vo. *London*, 1863

THE GEOLOGICAL SURVEY OFFICE.

Catalogue of the published Maps, Sections, Memoirs, and other Publications of the Geological Survey of the United Kingdom, up to March, 1865. 8vo. *London*, 1865

THE PROVOST AND SENIOR FELLOWS OF TRINITY COLLEGE, DUBLIN.

Catalogus Librorum Impressorum qui in Bibliotheca Collegii Sacrosanctæ et Individuæ Trinitatis Reginæ Elizabethæ juxta Dublin, adservantur. Tomus Primus, cum Supplemento. Continens Litteras A et B. Folio. *Dublinii*, 1864

THE AUTHOR.

Charley (William, J. P., &c., ...). Flax, and its Products in Ireland. 8vo. *London*, 1862

THE AUTHOR.

Clancarty (The Earl of). Ireland: her Present Condition, and what it might be. 8vo. *Dublin*, 1864

THE AUTHOR.

Cooke (M. C., President of the Society of Amateur Botanists . . . .), Rust, Smut, Mildew, and Mould. An Introduction to the Study of Microscopic Fungi. With . . . . Figures by J. E. *Sowerby*. 8vo. *London*, 1865

THE AUTHOR.

Davy (Edmund W., A. B., M. B., M. R. I. A., ...). On Flax, . . . with Directions for the Proper Management of that Crop. 8vo. *Dublin*, 1865

THE SECRETARY OF THE INSTITUTION OF CIVIL ENGINEERS.

Denton (John Bailey, M. Inst. C. E.). On the Discharge from Under Drainage, and its effect on the Arterial Channels and Outfalls of the Country. Edited by Charles *Manby*, F. R. S., M. Inst. C. E., ... and James *Farrest*, Assoc. Inst. C. E., ... 8vo. *London*, 1864

THE REV. BEAVER H. BLACKER, A. M., BOOTERSTOWN.

Dialogues of the Dead. The Second Edition. 8vo. *London*, 1760

THE ROYAL BAVARIAN ACADEMY OF SCIENCE.
Dossinger (J. V., ...). Konig Maximilian und die Wissenschaft. . . . .

THE AUTHOR.
Duncan (James, A. M., M. D. T. C. D.). Introductory Lecture delivered at the Adelaide Hospital, Dublin, at the Commencement of the Clinical Course, October 31, 1864. 8vo. *Dublin*, 1864

THE AUTHOR.
Duncan (James F., M. D. T. C. D., M. R. I. A. . . .). The Personal Responsibility of the Insane. 8vo. *Dublin*, 1865

THE REV. BEAVER H. BLACKER, M. A., BOOTERSTOWN.
. . . . *Dunciad*, Variorum. With the Prolegomena of Scriblerus. . . 4to. *London*, 1729

THE AUTHOR.
Eblanensis. Appeal to Cæsar; or Ireland's Last Fetter struck off: . . . . the Lord Lieutenancy . . . . 8vo. *London*, 1864

THE AUTHOR.
Frazer (Dr. William . . . .). Elements of Materia Medica: . . . . Drugs, their Effects, Doses, and Adulterations; . . . . Second Edition. 8vo. *London*, 1864

SECRETARY OF THE INSTITUTION OF CIVIL ENGINEERS.
Grantham (Richard Boxall, M. Inst. C. E.) On Arterial Drainage and Outfalls. Edited by Charles *Manby*, F. R. S., M. Inst. C. E. and James *Forrest*, M. Inst. C. E. 8vo. *London*, 1862

THE AUTHOR.
Hardinge (W. H., M. R. I. A.). Observations on the Earliest Known Manuscript Census Returns of the People of Ireland. From the "Transactions of the Royal Irish Academy," Vol. XXIV. 4to. *Dublin*, 1865

THE AUTHOR.
Hardinge (W. H., Esq.). A Memoir on the Manuscript Mapped and other Townland Surveys in Ireland. (1688–1864). From the "Transactions of the Royal Irish Academy," Vol. XXIV. . . . . 4to. *Dublin*, 1865

THE AUTHOR.
Hildige (James G., F. R. C. S. L., ...). Medical Sketches in Austria, Prussia, and Italy; . . . . Remarks on the Roman Campagna, and . . . . Hungary. 8vo. *Dublin*, 1859

H. I. M. THE EMPEROR OF THE FRENCH.
Histoire de Jules César. Tome Premier. 4to. *Paris*, 1865

THE ROYAL ASIATIC SOCIETY OF GREAT BRITAIN AND IRELAND.
Journal of the Royal Asiatic Society of Great Britain and Ireland. New Series. Vol. I. 8vo. *London*, 1865

THE AUTHOR.

Liharzick (F. P., Doctor of Physic and Surgery, ...). The Law of Increase, and the Structure of Man. Prospectus, with a fac-simile of Alexander de *Humboldt's* Letter. . . . . 4to. *Vienna*, 1862

THE AUTHOR.

Locke (John, A. B., etc.). On Arctic Discovery. [Read before the Royal Dublin Society, March 20, 1864.] 8vo. *Dublin*, 1865

THE CONSUL FOR THE UNITED STATES OF AMERICA IN DUBLIN.

Mackenzie (Robert). America, and her Army. 8vo. *London*, 1865

THE AUTHOR.

Madden (Thomas More, M. D., M. R. I. A.; . . . .). The Climate of Malaga, in the Treatment of Chronic Pulmonary Disease, ... 8vo. *Dublin*, 1865

THE AUTHOR.

Maw (George, F. S. A., ...). Notes on the Drift Deposits of the Valley of the Severn, ... 8vo. *London*, 1864

Maw (George, F. S. A., ...). On a supposed Deposit of Boulder Clay in North Devon. 8vo. *s. l., s. a.*

THE AUTHOR.

Moore (William, M. D., ...). Introductory Lecture delivered in the Ledwich School of Medicine, October 31, 1864. 8vo. *Dublin*, 1864

THE PROVOST AND SENIOR FELLOWS OF TRINITY COLLEGE.

Observations made at the Magnetical and Meteorological Observatory at Trinity College, Dublin: under the Direction of the Rev. Humphrey *Lloyd*, D. D., D. C. L., ... Vol. I. 1840–1843. 4to. *Dublin*, 1865

COLONEL RICHARD STRACHY, R. E. (by H. F. Blandford, Hon. Sec., Asiatic Society of Bengal).

Palæontology of Niti in the Northern Himalya: . . . . collected by Colonel Richard *Strachy*, R. E. Descriptions by J. W. *Salter*, F. G. S., A. L. S.; and H. F. *Blandford*, A. R. S. M., F. G. S. Reprinted . . . . for Private Circulation. 8vo. *Calcutta*, 1865

THE SECRETARY OF THE INSTITUTION OF CIVIL ENGINEERS.

Rennie (Sir John, President Inst. C. E.). An Account of the Drainage of Ancholme, Lincolnshire. . . . . 8vo. *London*, 1845

THE NATIONAL ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.

Report to the Annual Business Meeting of Members of the National Association for the Promotion of Social Science . . . . July 16, 1865. 8vo. *s. l., s. a.* [1865]

THE NATIONAL ACADEMY OF SCIENCES, WASHINGTON, U. S. A.

Report of the National Academy of Sciences for the Year 1863. 8vo. *Washington*, 1864

John Alexander Walker, M. R. D. S., Secretary of the Exhibition of Manufactures, 1864.

Royal Dublin Society.—Official Catalogue of the Exhibition of Manufactures, Machinery, and Fine Arts, 1864. Published by . . . . . the Exibition Committee. Second Editon.
8vo. *Dublin, s. a.* [1864]

The Author.

Sargant (William Lucas, ...). Inconsistencies of the English Census of 1861 with the Registrar-General's Reports: and Deficiencies in the Local Registry of Births. [Read before the Statistical Society, January, 1865].

F. J. Sidney, LL. D.

Smith (Gerard Edwards, ... Oxford). Catalogue of Rare or Remarkable Phænogamous Plants . . . . in South Kent . . . .
8vo. *London,* 1829

The Smithsonian Institution of Washington.

Smithsonian Institution.—Annual Report of the Board of Regents, . . for the Year 1862. 8vo. *Washington,* 1863

The Rev. Beaver H. Blacker, M. A., Booterstown.

Smyth (Captain W. H., R. N., K. S. F., ...). The Life and Services of Captain Philip Beaver, late of Her Majesty's Ship "Nisus."
8vo. *London,* 1829

Alexander Thom, Esq., M. R. D. S.

Statistics of the United Kingdom of Great Britain and Ireland. Reprinted, with Additions, from Thom's Irish Almanac . . . . for 1865. 8vo. *Dublin,* 1865

James Haughton, Esq., J. P.

Trail (R. T., M. D.). The True Temperance Platform; . . . . the Fallacy of Alcoholic Medication; . . . .
12mo. *New York,* 1864

The Academy of Science of St. Louis.

Transactions of the Academy of Science of St. Louis.
Vol. I. 1856–1860. *St. Louis,* 1860
Vol. II., No. 1. *St. Louis,* 1863

The Academy of Science and Literature, Palermo.

Transactions. Atti della Accademia di Scienze et Lettere di Palermo. Nuova Serie. Vol. II. 4to. *Palermo,* 1863

The Royal Academy, Amsterdam.

Transactions. Jaarboek van de Koninklijke Akademie van Wetenschappen. Gevestigd te Amsterdam voor 1863.
8vo. *Amsterdam, s. a.*

Idem, voor 1864. 8vo. *Amsterdam, s. a.*

The London and Middlesex Archæological Society.

Transactions of the London and Middlesex Archæological Society. Vol. II., Part VI. 8vo. *London,* 1864

THE NOVA SCOTIA INSTITUTE OF NATURAL SCIENCE OF HALIFAX, NOVA SCOTIA.

Transactions of the Nova Scotia Institute of Natural Science of Halifax, Nova Scotia. Vol. 2., Part 1. 8vo. *Halifax, Nova Scotia*, 1864

THE ROYAL SOCIETY OF SCIENCES OF UPSAL (by E. Fries, Secretary).
Transactions. Nova Acta Regiæ Societatis Scientiarum Upsaliensis. Seriei Tertiæ. Vol. V., Fasciculus Prior. 4to. *Upsaliæ*, 1864

THE PATHOLOGICAL SOCIETY OF LONDON.
Transactions of the Pathological Society of London. Vol. Fifteenth. . . . . Proceedings for the Session 1863–64. 8vo. *London*, 1864

THE UNIVERSITY OF KIEL.
Transactions. Schriften der Universitat zu Kiel, aus dem Jahre 1864. Band X. 4to. *Kiel*, 1864

THE PHILOLOGICAL SOCIETY.
Transactions of the Philological Society 1860–61, 1862–63, 1864. 3 vols. 8vo. *London and Berlin, s. a.*

THE AUTHOR.
Waller (John Francis, LL. D., V. P. R. I. A). Occasional Odes. 8vo. *Dublin*, 1864

THE AUTHOR.
Wright (E. Perceval, A. M., M. D., Dub., ...). Ophthalmological Notes. [Reprinted from the "Dublin Quarterly Journal of Medical Science," Feb. 1865]. 8vo. *Dublin*, 1865

(Signed) EDW. RICHARDS PUREFOY COLLES,
Librarian.

September 30, 1865.

BOTANIC GARDEN.

Mrs. W. HAUGHTON, *Moorfield, Roebuck*:—4 kinds of Fern Seeds.

Mr. ANDERSON, *Nurseryman, &c., Perth*:—21 rare and valuable Plants.

Dr. HARVEY, *Professor of Botany, &c.*:—1 Plant, and 1 Package of Seeds, from South Africa.

DITTO:—2 packages of South African Seeds.

DITTO:—1 Parcel of Seeds, and 1 of Bulbs, from Natal.

Messrs. BACKHOUSE, *Nurserymen, York*:—7 very rare Alpine Plants.

Mr. FRASER, *Nurseryman, &c., Comly Bank Nursery, Edinburgh*:—22 very rare Plants.

Mr. G. BAKER, *Thirsk, Yorkshire* :—7 packages of Seeds of rare English Plants.

W. THOMPSON, Esq., *Ipswich* :—4 rare Plants, and 7 packages of North American Seeds.

Mr. LEACH, through HENRY DEANE, Esq., *Clapham, London* :—2 fine Plants of the rare *Disa grandiflora.*

Dr. HOOKER, *Royal Gardens, Kew* :—2 kinds of Ferns, from West Indies.

DITTO :—2 kinds of Grass Seeds.

DITTO :—2 kinds of Tobacco Seeds.

Dr. M. A. WHITE, 142, *Capel-street*:—Punka, or Indian Fan, made from leaves of Palm, for Museum.

Messrs. HANDYSIDE, *Nurserymen, Musselburgh* :—Collection of new kinds of Dahlias.

JOHN G. LEMON, Esq., 30, *Upper Leeson-street* :—30 kinds of Australian Seeds.

Dr. MARTIUS, *Director, Botanic Garden, Montpelier* ;—146 kinds of Seeds.

H. G. REICHENBACH, *Director, &c. &c., Botanischer Garten, Hamburgh* :—39 kinds of Seeds.

Dr. CASPRAY, *Director, Botanic Garden, Konigsberg, East Prussia* :—146 kinds of Seeds.

Mr. ROBINSON, *Botanic Garden, Regent's Park, London* :—96 kinds of Seeds.

M. ORTGIES, H. M. R. D. S., *Inspector Botanischer Garten, Zurich* :—125 kinds of Seeds.

Dr. WALSH, *Harcourt-street* :—Seeds of a Poisonous Plant, from Australia, 1 parcel.

R. CLAYTON BROWNE, Esq., *Browne's Hill, Carlow* :—20 kinds of Seeds from New Zealand.

Signor TODARO, *Director, Orto Botanico, Palermo* :—500 kinds of Seeds—one of the most valuable donations of Seeds ever received in Dublin.

The Hon. JUDGE LITTLE, *St. Ives, Newfoundland* :—A fine supply of Plants of *Sarracenia purpurea.*

W. R. BAYLY, Esq., 1, *Hardwicke-street, Dublin* :—Wardian Case filled with scarce Plants, from Bombay; also 17 parcels of Seeds, from Bombay.

June 1, 1865. (Signed) D. MOORE, *Director.*

NATURAL HISTORY MUSEUM.

Captain Meadows Taylor, *Old Court, Harold's Cross*:—A pair of Partridge (*Pterocles*), from India.

Dr. M'Gusty, *Slane*:—A stuffed Ant-eater (*Myrmecophaga jubata*), South America.

Joseph Fulton, Esq., M. D., *Roebuck House, Miltown*:—3 Bird Skins, from Dacca, India.

Major Borrowes, *Gilltown House, Kilcullen, Co. Kildare*:—Some Ethnological Specimens from South America.

Captain F. W. Hutton, 8, *Waterloo-road*:—A specimen of *Petrocincla cyanea* (male), from Malta.

Lieutenant-General Costley, M. R. D. S., 6, *Fitzwilliam-square, East*:—3 Ostrich Eggs; a small bottle of Gulf Weed (*Sargassum bacciferum*); a Hookah bottom, found in the Begum's Palace at Lucknow, after the mutiny of 1857; 53 Mineral Specimens, chiefly Copper Ores, from Australia; 14 other Mineral Specimens, locality not specified.

Ditto:—3 Bird Skins—viz., one of the Snow Partridge (*Lerva nivicola*); one of the Cooklas Pheasant (*Pucrasia macrolopha*), male; and the 3rd, that of the Horned Pheasant (*Ceriornis melanocephala*), female.

Robert Reeves, Esq., M. R. D, S., 22, *Merrion-square, South*:—The Skins of two Bee-eaters; and one Skin of a Hoopoe, from Astracan.

Henry Hutchings, Esq., *Fairy Villa, Sandymount-avenue*:—A Ringed Plover (*Charadrius hiaticula*).

Joseph Lamprey, Esq., *Molesworth-street*:—A Rock Partridge (*Pterocles quadricinctus*), from India.

Fergus Smith, Esq., 71, *Lower Baggot-street*:—A specimen of the Tree Sparrow (*Fringilla montana*), male.

Richard Williams, Esq., 38, *Dame-street*:—A specimen of a Decoy k.

Joseph Scott Moore, Esq., 12, *Hume-street*:—4 Hares, and 3 specimens of Fossil Shells.

James Acheson Lyle, Esq., 7, *Pembroke-place*:—10 Bird Skins, from New Zealand.

Messrs. Walpole, Webb, and Bewley, *North-wall*:—A Bird's Nest, with the remains of three broken eggs in it, built in a hollow caused by decay in the trunk of an Elm Tree; the entrance to the nest being subsequently closed up by the growth of the bark.

WILLIAM COBBETT, Esq., *Castleconnell, Co. Limerick*:—A stuffed specimen of an Osprey (*Falco haliaëtus*), shot at Castleconnell, November, 1864.

G. HENRY KINAHAN, Esq., Geological Survey of Ireland:—A specimen of Native Sulphur in Limestone, from the Co. Galway.

Rev. BENJAMIN ADAMS, 4, *Upper Pembroke-street*:—6 specimens of *Helix bicarinata*, from Madeira.

JOHN BEATTY, Esq., Executive Engineer, P. W. D., Bombay Presidency, 52, *Upper Leeson-street*:—2 Bustards, from Central Scinde.

RICHARD E. POWER, Esq., M. D., R. M. S. "Trent," *St. Thomas's Island, West Indies*:—4 Bird Skins from the West Indies.

(Signed) ALEXANDER CARTE, M. D., *Director*.

Sept. 25, 1865.

INTELLIGENCE.

SCHOOL OF ART.—ANNUAL DISTRIBUTION OF PRIZES.

THE annual distribution of Prizes to the Students of the School of Art, and of the Parochial and other similar Schools in connexion with it, took place on Saturday, December 24, 1864, in the Lecture Theatre, in presence of an audience numbering 745 persons.

The Chair was taken by

HIS EXCELLENCY LORD WODEHOUSE, Lord Lieutenant of Ireland, President of the Society.

MR. GEORGE WOODS MAUNSELL, one of the Honorary Secretaries, said that in the absence of Lord Dunlo, the duty devolved on him of introducing the subject of the day. As on former occasions, they had asked the attendance of the Lord Lieutenant to distribute the Prizes to the successful candidates in the Drawing School; and when he pointed attention to the goodly number of Prizes before them, including the National Medallions, which were the highest honors that the Government awarded for progress in the arts, he could not but think that they might look with some little pride to the proceedings of their Schools. The Schools of the Royal Dublin Society had long taken a high rank as places of instruction in the Fine Arts. They were the oldest schools in the country, and might be called the parent of all those drawing schools which in later years had sprung up, and were now widely spread over the whole face of the country. The Dublin Society was pointed at by Arthur Young, in his Tour through Ireland, as being the parent of all the societies that had sprung up for the improvement of the arts and useful sciences; and the Schools now before His Excellency's notice were the very oldest of the drawing schools in the United Kingdom, being now something like ninety-five years in existence. During the long period that those schools had been in operation, their services had been of no slight moment. He would not dwell on the history of ages gone by, but would state that within the last few years the important change connecting those

Schools with the Department of Science and Art, and placing the works here executed in competition with all the similar works executed throughout the length and breadth of the land, had given a new importance and an additional stimulus to the education here carried on. At one time within the last fifteen years the Society enjoyed a small annual grant from the Government for promoting the progress of art in these Schools. For reasons with which he should not now trouble them, that grant was discontinued, not only to theirs, but to all the other similar schools, which were then left to rely upon their own unaided exertions. It was gratifying, under those circumstances, to know that the Dublin Society did not shrink from the duty imposed on it. They had supported their Schools without allocating to them a farthing of the money derived from their Parliamentary grant; and it was no small gratification to know that during the last year the numbers in those Schools had increased something like twenty-five per cent., and their income had increased in like proportion, being in excess of the former year. They stood in some degree in a different position from that of many of the schools of the great towns in England; for while they were enabled by the rules of the Department of Science and Art to supplement the pupils' fees by aid derived from that important Department, in the shape of payment for results, from the nature of the material from which the Dublin Society's Schools were furnished with recruits, they had but small assistance in that way. The Department of Science and Art limited their assistance in the way of payment for results to the schools used by those who might be termed the artizan class; and it was within the knowledge of every one in that room, and in some degree of His Excellency, that the pupils of the Dublin Society's Schools were recruited from the higher classes generally in Dublin; and they were, therefore, debarred from obtaining the State assistance which, under other circumstances, was given to schools in Birmingham and Leeds—in point of fact, the higher classes of Dublin were partaking of and supporting the Art Schools for the benefit of themselves and of the artizan classes. The merit of the prizes given to-day was greatly enhanced by the fact that, in consequence of a change which had been made in the period of examination, the time for preparing the works which had entered into competition with all the schools in the kingdom had been reduced to half the usual period—from twelve months to six. Until last year the examination of the works prepared in their Schools, and subjected to competition in the South Kensington Museum, had taken place in October. For reasons that did not fall within the power of the Society, and with which they had nothing to do, the Department of Science and Art last year advanced the examination from October to March. Notwithstanding the strain thus suddenly placed on the pupils of the School, it would be gratifying, not more, he was sure, to the Society than to His Excellency, to know that they had acquitted themselves with even more than their ordinary success. Last year two National Medallions were awarded to these Schools; in the present year they had gained four, being, he believed, the largest number ever awarded to them. He looked forward with confidence to that number being increased, under the able instructor now at the head of the Schools; and with regard to the second class of prizes, namely, the local medals, he believed they had reached the extreme number that by the rules of the Department of Science and Art could be conferred. The principle aimed at in their Schools was that of giving sound instruction, rather than accomplishing hasty results; and on that sound principle of instruction they looked forward to the intellectual development of their pupils, and to the spread of taste, which could never be attained without a solid foundation of early teaching. They pointed with some credit to the works now displayed in the room, which had stood the test of competition with the United Kingdom, although many of those which had obtained prizes had been withdrawn by their owners. He might add, that amongst the prizes to be given was one for which they were indebted to a benefactor of the Society, the late Mr. Taylor, who had left a sum of money at the disposal of the Society, from which a prize was each year to be

awarded. They pointed with some degree of pride to the sketch on the wall, entitled "The Good Samaritan," which had not only obtained one of the National Medallions awarded by the Department of Science and Art, but had also won the Taylor Prize for this year of £20. The Society could look back to a long list of worthies who had been educated in its Schools. To His Excellency, perhaps, the list was not so familiar; but they could point to Ganly, Kirke, Cregan, Lawlor, Mossop, Panormo; Sir Martin Archer Shee, the President of the Royal Academy of London; Rothwell, Deane, and finally to a gentleman who was now at the head of his profession in London—namely, Foley,—as having drunk at their fountains there that early instruction which had enabled them to cope with the great artists of the day. When he had mentioned that list, which included distinguished painters, distinguished sculptors, and architects, he trusted that His Excellency would be of opinion that that time-honoured School had maintained a high character; and why should they not hope that amongst those who were about to receive prizes that day were some who would in future years be ranked among those eminent artists who had gone before them, and would add fresh laurels to that ancient and honourable Society? With these remarks, he would introduce Colonel Adamson, the Chairman of the Fine Arts Committee, whose attention to that department had been at all times unremitting, and under whose guidance, as chief of the Committee, these Schools had been for the last year more particularly placed.

Lieutenant-Colonel Adamson said—It is my duty, as Chairman, in the name of the Committee of Fine Arts of the Royal Dublin Society, to express to your Excellency and Lady Wodehouse their appreciation of the honour you have conferred upon their department in favouring them with your presence on this most interesting occasion. The successful pupils of this institution are to have the high honour of receiving at the hands of your Excellency those rewards and honorary distinctions, the fruits of long and arduous study—prizes that will be valued by them to their lives' end, and that, doubtless, will prove a great additional stimulus to the zeal and ardour with which they and others will continue their studies. Since our meeting of the last year we have been deprived by the hand of death of the lamented Earl of Carlisle; and, in common with all in this country, we deeply deplore his loss, and we have special reason to feel that our Society has lost one of its brightest ornaments, one of its sincerest supporters. However, from this sorrow we look with confidence to the future; and we are convinced that at your Excellency's hands we shall meet with equal encouragement—the same powerful support, the same valuable assistance, as we invariably received from your distinguished predecessor. We are happy to be able to prove that the condition of this School of Art has been rapidly improving, not only in numbers, but also in progress and teaching; and it is with feelings of the utmost satisfaction that we can point to the existence of a growing taste amongst our humble fellow-citizens for the cultivation of those finer studies which formerly were beyond their reach; and we do not think it out of place in this presence to express our conviction that the various humanizing influences which, by the great establishments of the Royal Dublin Society, have been brought to bear upon the lower classes of our metropolis, have shown their value, and are conducing to the orderly and improved habits of numbers of the people, thus cheering us with the hope of effecting some lasting good for our country. In this view we hail with pleasure, and regard with interest, the preparations which are being made for the forthcoming International Exhibition, and earnestly wish it the success so great an undertaking most richly deserves, and we anticipate from it great advantages for our pupils and others. The treasures which will be then collected, and many great works of art which will be comparatively new to great multitudes of our countrymen, cannot fail to delight and please, and certainly will effect more lasting advantages than those of mere transient pleasure. Your Excellency's presence this day is received by

us as a convincing proof of the favour in which this department of the Royal Dublin Society is held in the opinion of Her Most Gracious Majesty's Representative in Ireland.

REPORT OF THE SCHOOL OF ART OF THE ROYAL DUBLIN SOCIETY FOR THE YEAR ENDING DECEMBER 31ST, 1864.

The Prizes to be distributed on this occasion consist of the Silver and Bronze Medals of the Society, the Prizes founded under the will of the late Captain Taylor, awarded to studies of an advanced character, and the following awards of the Department of Science and Art, viz.—Local Medals and National Medallions, for Drawings executed in competition in the various stages of Art instruction recommended by the Department; Books and Drawing Instruments, for success in Linear and Freehand time exercises, executed in the presence of the Art Inspector; and, lastly, Prizes to pupils of Parochial Schools and similar Institutions in and about Dublin taught by the agency of the School of Art.

The attendance of students during the past year has been 434, showing an increase of nearly 100 over the preceding year, 1863; the income derived from fees for the past year amounts to £383 8*s.* 2*d.*, showing an increase of £102 17*s.* 3*d.* for the year which is past.

The works of the students executed in competition for Local Medals and National Medallions of the Department of Science and Art were forwarded to London for examination in March last; in previous years the examination of students' works took place in the month of October, in the School of Art; consequently, the works examined on the last occasion were produced in half the usual period: notwithstanding this, the result was most satisfactory; twenty Local Medals were obtained, and five works received honourable mention; ten Drawings were selected for national competition, and of these four gained National Medallions, being the greatest number ever obtained by this School. The National Medallion is the highest honour given by the Department, and made only to works of great excellence. In addition to this, two of the Drawings received national honourable mention, and four have been purchased by the Department as specimens to be used in Schools of Art.

The examiners on this occasion were—Sir Charles Eastlake, President of the Royal Academy; Richard Redgrave, R. A.; Daniel Maclise, R. A.; and Henry Alexander Bowler, Chief Inspector. In the Report of the Department it is stated—"The Inspectors remarked a great improvement in the Drawings, inasmuch as the Elementary works were more carefully executed, and those in the more advanced stages showed better composition and execution, and at the same time competed well with one another." Of the three works selected for national competition from the examination of October, 1863, one Medallion award was made on the same occasion.

At the recent examination of the School by Eyre Crowe, Esq., Her Majesty's Art Inspector, forty-two students passed examinations in one or more subjects, the number of papers passed by these forty-two students being sixty-three; eighteen students gained Prizes, and the remainder, certificates.

The number of pupils who presented themselves for examination from external Schools and who receive instruction in Drawing by the agency of the School of Art, was 558, out of which number 118 succeeded in gaining prizes and 187 in passing in exercises of the first grade, whilst eight gained prizes, and five passed in second grade papers; the broad result of the examination being, that 415 students and pupils gained prizes and passed examinations in the various time exercises given by the Art Inspector.

Upon comparing the total number of successful students and pupils for the year, 1863, with those for the past year, we find that they amount to 112 for the former, and 409 for the latter.

Since Oct. 1863, the numbers of those receiving instruction in drawing in Public Schools and Institutions in Dublin has increased from 900 to 1900; and there is every reason to believe that the sound and thorough system of instruction in elementary drawing which has already produced such favourable results will in a short time become general,

and be introduced into schools of every description. It is very gratifying to learn that many of these Pupils afterwards prosecute their studies in the Central School, and become skilled draughtsmen.

In January last, Mr. F. Walker, Mr. W. H. Murray, and Mr. E. C. R. Byrne, were re-appointed Art Scholars by the Department.

Prize Studentships have been revived, and are granted for one year by the Society to those who pass an examination in Freehand Drawing, Practical Geometry, Perspective, and Model Drawing, and who also take a Local Medal at the annual examination of Students' works, such Studentships being renewable, should another Local Medal be gained; the names of those who have thus distinguished themselves will be found in the Prize list.

The Taylor Prize has this year been gained by Mr. Francis Walker, for a Cartoon of the Good Samaritan.

The Silver and Bronze Medals of the Society have been awarded for the following subjects :—

Two	Silver Medals	for Painting from the Life.
Two	do.	for Drawings from the Antique.
One	do.	for Landscape from Nature.
One	do.	for Design for Manufacture.
One	do.	for Architecture from actual measurement.
One	do.	for Anatomy.

And Three Bronze Medals for the following subjects ;—

Geometrical Drawing, Pespective, and Model Drawing.

Upon the whole, we have every reason to congratulate the Society upon the great progress made by this important School during the past year, there being a large increase in the numbers attending, in the number of Medallions, Medals, and Prizes awarded, and in the amount of fees received, together with a visible improvement in the works produced by the students.

Perhaps in no country of Europe, not even excepting France, do Schools of Art exist in which the training is so complete and the subject of study so varied as in the Art Schools of Great Britain; and experience proves that the language, so to speak, and the mechanical of art, may be taught to all, or at least to all possessed of ordinary capacity; and it is most gratifying to find that students of every class submit more readily than formerly to a preliminary training in those elements which, if not highly interesting, are at least essential to a successful cultivation of Art; particularly so in a School like this, established with the object of affording a knowledge of the principles and practice of Art involved in Form, Light, and Shadow, and Colour, and of improving and embellishing objects of use or luxury both with regard to symmetry and harmonious colour, and by so doing, rendering them not less useful, but more beautiful.

Happily the time has nearly passed away in which cottages, castles, and watermills of a painfully picturesque character, were the beginning and the end of a course of Drawing. The Chromo-lithographs so numerous at the present day are, with few exceptions, calculated to exercise an evil influence on the taste, the colour being generally crude, and the execution mannered. The too early study of Landscape may be said to be injurious, tending to retard the acquisition of a high or refined feeling for, and power over Form. The consideration of pure form and pure proportion, seen in such perfection in the admirable productions of ancient Greece and Rome, combined with the study of the living Figure, is necessary not only to those who make, or intend to make, the Figure a speciality, but also to such as desire to attain to a high degree of proficiency in Landscape; and not alone to such as these, but to the designer also; and there is every reason to believe that the superiority of French designs is in a great measure due to the fact that the producers are men who have studied the form and colour of the living model: in short, ornament is the offspring of High Art, demanding skilful teatment, and judicious management of forms and colours, depending on something more than the exercise of the

lower faculties of the mind, and requiring a knowledge of the causes and principles of beauty, which depend upon laws which are unchangeable and eternal. The love of the beautiful, which may be said to be universal, is felt in its highest degree only by those who have sought after it by long and patient study.

We cannot close this Report without alluding to the recent recommendations of the House of Commons' Committee, appointed to inquire into the management of Schools of Art, one of which is, that Local Medals should be discontinued. Such a measure would undoubtedly prove injurious to the Schools generally, as a great incentive to the production of works of a high degree of excellence would thereby be removed.

In our examination of the Works sent for competition for the Taylor Prizes in 1864, we have to express our regret that more numerous specimens of native talent have not been offered for our inspection.

The Cartoon of "The Good Samaritan," by Francis Walker, evinces a considerable amount of patient study, with attention to drawing and composition, and to this work we recommend that a Prize of £20 be awarded. We are unable to consider formally the subjects in oils, one of which is of careless execution, and presented in a very unfinished state.

We venture to offer for the consideration of the Trustees a list of subjects, which, being of a more simple character than the works hitherto sent in, may have the effect of increasing competition in the various branches of Art.

For the best Composition of Figures in outline, in size not less than 36 x 28 the subject to be selected by the student, a Prize of £10.

For the best finished Drawing from the Nude figure in chalk, same size, the subjects to be "Narcissus at the Fountain," and "Venus rising from the Sea," each a Prize of £10.

For the best Study from Nature of a Group of Trees in oils, size 24 x 20, a prize of £10.

For the best Study of the same in Water Colors, same size, a Prize of £10.

The Judges are of opinion that the arrangement of Prizes as above suggested, as being given for subjects of a more simple character than those hitherto offered, will produce a greater amount of emulation among Art Students, and tend more fully to carry out the intentions of the Testator.

George Hodson, Bart.
Catterson Smith.
George Colomb, Major-General.

December 14th, 1864.

The students who had gained the prizes were then introduced to His Excellency, who presented them with their prizes in the following order:

SOCIETY'S PRIZES.

Painting from the Life.—Miss Kate Seymour, first silver medal; Miss Maria D. Webb, second silver medal; Miss Frances Seymour, honourable mention; Miss Matilda Stoker, honourable mention.

Drawing from the Antique.—For the best Drawing in Chalk of a Figure, two feet high, from the Antique.—Miss Emily S. Ryder, first silver medal; *For the best Drawings in Chalk, of a Head, Hand, and Foot, from the Antique*—Miss Emily S. Ryder, second silver medal; Miss Elizabeth Smith, honourable mention.

Artistic Anatomy.—Edmund C. Byrne, first silver medal.

Landscape from Nature.—Miss Kate Seymour, first silver medal. The Landscape department being very good, the Judges recommend that an additional silver medal be awarded to Miss Anna Ruxton. Edmund C. Byrne, honourable mention. The Judges recommend that, in future, two silver medals shall be given in Landscape—one for Oil, and another for Water Colours.

Original Designs for Manufactures.—Henry Felix Thomas, first silver medal.

Architecture.—For the best Drawing to scale of a Public Building in Dublin. Henry Edward Hall, second silver medal.

Model Drawing.—William Henry Murray, bronze medal.

Geometrical Drawing.—Roderick O'Farrell, bronze medal. The industry and ability manifested in Geometrical Drawing were considered by the Judges to be very praiseworthy.

Perspective Drawing.—Miss Susan E. Davis, bronze medal.

TAYLOR PRIZE.

Cartoon of the Good Samaritan.—Francis Walker.

PRIZES AWARDED BY THE DEPARTMENT OF SCIENCE AND ART.

National Medallions.—Miss Emily S. Ryder, Painting in Monochrome of the Human Figure from the Antique; Francis Walker, Drawing in Chalk from the Antique; Francis Walker, Shading Ornament in Chalk from the Cast; Edmund C. Byrne, Anatomical Studies, painted in Water Colours; Miss Fanny Trout, Studies of Historic Styles, painted.

Honourable Mention.—Miss Mary K. Benson, Historic styles of Ornament; James Lynch, ditto.

Local Medals.—Thomas Holbrooke, Outline of Ornament from the Flat; Robert Walsh, ditto; Miss Frances Seymour, ditto; Miss Elizabeth J. Bredin, Shading in Chalk of Ornament from the Flat; Roderick O'Farrell, Outline of the Human Figure from the Flat; Miss Frances Seymour, Outline of the Human Figure and Animals from the Cast; Miss Charlotte E. Benson, Painting of Ornament in Oil Colours from the Flat; Miss Louisa Samways, Painting of Ornament in Monochrome from the Cast; Miss Elizabeth Fulton, ditto; Miss Susan Johnson, ditto; Miss Charlotte Kenny, Painting of Flowers in Water Colours from the Flat; Miss Kate Seymour, Painting of Landscape in Water Colonrs from the Flat; Miss Harriette M. Everth, Painting of Flowers in Water Colours from Nature; Miss Minnie P. Colles, ditto; Miss Kate Seymour, Painting of Landscape in Water Colours from Nature; Miss Kate Seymour, Painting of the Human Figure in Monochrome from the Cast; Miss Emily S. Ryder, ditto; Miss Mary K. Benson, Studies of Historic styles, painted; Miss Fanny Trout, ditto; James Lynch, ditto.

Honourable Mention.—Miss Eliza Anderson, Drawing of the Human Figure in Outline from the Flat; Miss Clara S. Bayly, Painting of the Human Figure in Monochrome from the Cast; Joseph Watkins, Modelling of Fruit from Nature; Miss Lizzie Lambert, Original Design for a Carpet; Miss Margaret Bredin, Historic Styles of Ornament, paintèd.

Second Grade Prizes.—Miss Eliza Anderson, Geometry and Perspective; John B. Anderson, Freehand and Model; Miss Matilda Booth, Geometry and Perspective; Miss Mary A. Bredin, Geometry and Perspective; Joseph Chapman, Freehand; Ephraim Dunckley, Freehand; Miss Harriette M. Everth, Freehand; Miss Josephine Fulton, Geometry, Perspective, and Model; Miss Elizabeth E. Irwin, Freehand, Geometry, and Model; Miss Marcella Irwin, Freehand, Geometry, Perspective, and Model; John Johnston, Freehand; Miss Margaret Kennedy, Freehand and Geometry; Miss Sydney J. Moore, Freehand; James Rock, Freehand; Miss Delia Ryan, Model and Freehand; Miss Louisa Samways, Mechanical; Miss Frances V. Seymour, Freehand and Model; Henry Felix Thomas, Freehand and Model; Joseph Watkins, Freehand, Geometry, and Perspective; William F. M'Kittrick, Freehand.

Second Grade Certificates.—Miss Lucy M. Barney, Geometry; Miss Elizabeth F. Bredin, Geometry; Miss Elizabeth M. Brett, Freehand; Miss Frances M. Brett, Freehand; Joseph Campbell, Freehand; Henry Wm. Campling, Freehand; Joseph Donohoe, Freehand; Samuel H. Ellis, Freehand; Miss Elizabeth

Fulton, Perspective; Thomas W. Hicks, Freehand; Miss Ellen Hyland, reehand; Rickard E. Lloyd, Geometry and Perspective; James Lynch, Geometry; Charles M'Cormick, Geometry; Miss Catherine M. Moore, Freehand; Miss Mary A. Morgan, Freehand; Gerald Murray, Freehand; Alexander Robinson, Freehand and Geometry; Miss Anne F. Ruxton, Freehand and Perspective; Miss Matilda Stoker, Geometry and Perspective; Robert T. Walsh, Perspective; John Witchell, Freehand and Model; Fletcher Smith, Freehand; Michael Stanley, Geometry.

Prize Students from October, 1863, to October, 1864.

Roderick O'Farrell; Miss Emily S. Ryder; Miss Hester A. Harman; Miss Harriette E. Harman; Miss Jane M. Underwood; Miss Isabella Lambert; Miss Lizzie Lambert; George Brennan; Miss Clara S. Bayly; Miss Susan Johnson.

Prize Students from October, 1864, to October, 1865.

Miss Frances Seymour; Miss Louisa Samways; Miss Elizabeth Fulton; Miss Josephine Fulton; Miss Emily S. Ryder; Robert Walsh; Roderick O'Farrell.

PRIZES AND CERTIFICATES.

Model School of the Church Education Society, Kildare-place.—Art Teacher, Mr. William H. Murray. Second Grade Prize, 1; Do. Certificates, 5; *First* Grade Prizes, 24; Do. Certificates, 58.

King's Hospital School, Blackhall-place.—Art Teacher, Mr. William H. Murray. First Grade Prizes, 21; Do. Certificates, 24.

Ralph Macklin's School, 40, Camden-street.—Art Teacher, Mr. Edmund C. Byrne. First Grade Prizes, 8; Do. Certificates, 15; Second Grade Prizes, 2; Do. Certificates, 2.

St. Mary's Parochial School, Lower Dominick-street.—Art Teacher, Mr. W. H. Murray. Prize, 1; Certificates, 14.

Mercer's School, Blanchardstown, Co. Dublin.—Art Teacher, Mr. William H. Murray. First Grade Prizes, 7; Do. Certificates, 13.

Morgan's School, Blanchardstown, Co. Dublin.—Art Teacher, Mr. William H. Murray. First Grade Prizes, 5; Do. Certificates, 11.

Castleknock Parochial School, Castleknock, Co. Dublin.—Art Teacher, Mr. William H. Murray. First Grade Prizes, 6; Do. Certificates, 11.

St. Bride's Parochial School, Bride-street.—Art Teacher, Mr. Edmund C. Byrne. First Grade Prizes, 5; Do. Certificates, 6; Second Grade Certificates, 2.

St. Michan's Parochial School, Bow-street.—Art Teacher, Mr. Francis Walker. First Grade Prizes, 6; Do. Certificates, 6.

St. Lawrence O'Toole's School, Usher's-quay.—Art Teacher, Mr. Edmund C. Byrne. First Grade Prizes, 6; Do. Certificates, 2.

St. Nicholas (Without) Parochial School, New-street.—Art Teacher, Mr. Francis Walker. First Grade Prizes, 4; Do. Certificates, 4.

St. Anne's Parochial School, Molesworth-street.—Art Teacher, Mr. Francis Walker. First Grade Prizes, 4; Do. Certificates, 4.

St. Catherine's Parochial School, Thomas-court.—Art Teacher, Mr. Francis Walker. First Grade Prizes, 4; Do. Certificates, 3.

St. Peter's Parcohial School, 17, New Bride-street.—Art Teacher, Mr. Francis Walker. First Grade Prizes, 5; Do. Certificates, 2.

St. Werburgh's Parochial School, Werburgh-street.—Art Teacher, Mr. Edmund C. Byrne. First Grade Prizes, 5; Do. Certificates, 6.

St. Patrick's Parochial School, South-close.—Art Teacher, Mr. Edmund C. Byrne. First Grade Certificates, 5.

St. Mark's Parochial Schoo., Westland-row.—Art Teacher, Mr. Francis Walker. First Grade Prizes, 2; Do. Certificate, 1.

St. John's Parochial School, Fishamble-street.—Art Teacher, Mr. Francis Walker. First Prize, 1; Do. Certificate, 1.

St. Andrew's Parochial School, St. Andrew-street.—Art Teacher, Mr. Edmund C. Byrne. First Grade Prizes, 6; Do. Certificates, 1.

Tailor's Hall School, Back-lane.—Art Teacher, Mr. Francis Walker. First Grade Prizes, 3; Do. Certificates, 8.

Claremont Deaf and Dumb Institution, Glasnevin, Co. Dublin.—Art Teacher, Mr. William H. Murray. First Grade Prizes, 2; Do. Certificates, 3.

The Prizes to the Students in the Parochial Schools were handed to the Masters of those Schools.

The Hon. George Handcock moved a vote of thanks to the Lord Lieutenant for his kindess in attending. He was understood to say that it was very gratifying to see so large an assemblage present, and especially so to see such a number of the fair sex taking an interest in their proceedings. A deceased friend of his, the late Dr. Harrison, who many years ago foretold the success of that school, would have seen the fulfilment of his prediction had he been spared to that day. He might be permitted to say that, whether the action of the Royal Dublin Society was directed to the encouragement of agriculture, trade, or manufactures (with which they had not now to deal), or to the fostering of Schools of Art, the one sole motive by which they were animated was to do all that lay in their power for the country.

The Right Hon. the Lord Chancellor seconded the motion, which was passed with acclamation.

His Excellency then said—My Lord Chancellor, Ladies, and Gentlemen, I must first return my sincere thanks for the kind manner in which you have been pleased to give me your thanks for attending on this occasion. I should be wanting in my duty if I had not attended, and I should have lost the opportunity of assisting in a very interesting ceremony. I think you have had so full an account of the condition of the Society, and of its successful working—you have seen with your own eyes so many of the successful competitors present themselves upon this occasion, that in point of fact very little is left for me to say with regard to the Society itself, but to congratulate you most heartily upon the great success which the Society has evidently achieved; because it is clear that, having been long established, long known, it has not lost in popularity from the length of time it has existed, but it has shown that which is the surest proof of life in an institution of the kind—namely, that year by year it has gained strength and gained popularity, and made greater and greater progress. I think, therefore, you have every right to congratulate yourselves that this Society has achieved the objects, to a considerable extent, for which it was founded; and that it has taken such firm root, that it is not likely easily to fail to carry out the intention which its promoters had in view. Now, I must say that I have been very much struck with the great success alluded to already by my learned friend the Lord Chancellor, which the ladies have achieved on this occasion; and it certainly is a very strong argument in favour of those who think that, with more extended opportunities, those who belong to the other sex might find very dangerous competitors in various walks of industry which they have been accustomed to monopolize to themselves. At the same time, while I am exceedingly glad to see that the fair sex have achieved so large a share of success on this occasion, I rather wish, for the credit of my own sex, that there had been more male competitors; and I must suppose that in point of fact there did exist a large number of such competitors, but that unfortunately the excellence of the fair sex has been so pre-eminent, that they have not had that reward which their labours no doubt richly deserved. I trust the

ladies will not think me envious or jealous in expressing a hope that, although they may continue to maintain their position, yet that I may have the pleasure, should it be my lot to preside here again at a similar ceremony, of welcoming a few more competitors with whom, of course, I must feel a special sympathy. There was another topic alluded to by Mr. Woods Maunsell, and which characterizes to a very considerable extent institutions of this kind throughout the United Kingdom—that is, the absence of artizan competitors. Undoubtedly that has been used as an argument against affording Government assistance to institutions of this kind; and having been myself a member of an institution of a similar kind in England, in a manufacturing town, for encouragement to local designs, I confess I have been much disappointed at the very small encouragement which that society has received from the manufacturers and from the artizans. Now, I would not, for my part, hastily conclude that therefore these societies have not been of great assistance to the arts and manufactures of the United Kingdom. One thing, at least, is certain, that those who have watched the progress of our arts and manufactures during the last fifteen years must be struck with the great and important improvement that has taken place in our taste in every branch of art manufacture; and all those who have been previously acquainted with the productions of foreign countries must have known that, while we are exceeded by none in the cheapness with which we can produce articles of common use, and the durability of many of these articles, yet we do fall lamentably behind foreign manufacturers in the taste and beauty of the articles which we offer for sale. In the strong and difficult competition to which manufacturers of all classes are exposed in these days, you may depend on it that if they neglect beauty and taste in the articles they manufacture, they will find in the long run, as education and intelligence increase throughout the land, that the manufactures they have hitherto been able to sell in such enormous quantities will probably not meet with all that demand which we desire they should meet with. That is probably a distant future; but it becomes men to look forward to that which will inevitably take place, and it is, therefore, a matter of sincere congratulation to all who belong to the United Kingdom to know that we have made very great and striking progress in that respect. To some extent it seems as if the great start had been taken at the time we had the first great Exhibition in London, which drew attention to the excellence of the manufactures of other countries. I should not for myself be disposed altogether to attribute it to that Exhibition, because, no doubt, the result must to a great extent be attributed to a number of concurring causes; but I think the moment was most happily chosen by one who has, perhaps, done more for art of late years in the United Kingdom than any other individual—I mean the late Prince Consort. I think the moment was most happily chosen by him to inaugurate a movement which has undoubtedly given a great stimulus to the cultivation of taste in our own national fabrics. This improvement is shown in nearly all our manufactures. Every one, I suppose, knows the immense improvement that has taken place as regards the taste exhibited in the manufacture of our porcelain and china. That, perhaps, is the most conspicuous instance. I might add another which has not lagged behind in point of taste—namely, the manufacture of glass. All who saw the Exhibition in London of 1862 must have been struck with the very large improvement which has been made in our manufacture of glass, and with the very beautiful objects which were then produced, rivalling almost the splendid glass produced by the Venetian and other manufacturers of old. Now, I have observed, with great interest, that the improvement has been gradually extending itself to other works of art which we had not previously seen it exhibited. Those who had the good fortune to see what was known as the Loan Museum at Kensington, in 1862, must, I am sure, have been struck with the magnificent collection of silver and gold plate which was to be seen on that occasion; and it is very gratifying to observe, that at last—I say at last—the manufacturers

—I will not call them manufacturers, they deserve a higher name—the artists who work in silver and gold in the United Kingdom have found out that they committed a grievous mistake in departing from those beautiful forms which formerly distinguished our manufactures, and that they have begun to discard that overloaded florid style which they so long followed, and to recur again to those admirable models which are nowhere to be found in greater perfection than among the objects of silver which were produced during the time of Queen Anne and the subsequent period. This shows that the atmosphere, as I may say, of taste, is gradually widening; and I do not despair of seeing it embrace every art and manufacture that is followed in the United Kingdom. And I am confident that from that will result not only what undoubtedly is usually the point most looked at by our great capitalists and manufacturers, namely, the production of wealth, but also another most admirable effect, that through the introduction into the manufacture of articles in common use of a greater degree of taste you will stir up in the great mass of the people what I have no doubt is latent in their minds—the true feeling for the beautiful; and that, allow me to say, is no small part of civilization. For every man, though he may not be rich, and may not have the power of obtaining the splendid porcelain ware which I have been alluding to, may yet have about him in the commonest earthenware objects of taste, which, when they are there to please his eye and to instruct his mind, will render his home far more agreeable to him than it would be if he were surrounded by objects of a repulsive and even hideous character. I know nothing which is of more importance in these days than that we should impart to the minds of all classes a taste for the beautiful; and I therefore greatly rejoice to find in Dublin a Society characterized by so large a measure of success as this Society has attained to. And there is no reason to regret this cultivation of tasteful pursuits, because it may not be the case at present that Ireland has such manufactures as exist in England. Now, you have one great and important manufacture in this country—namely, the linen manufacture; and you give to a great number of persons an opportunity of employing their talents where that manufacture exists; and though there may be regret in the minds of some persons, that many, as I have heard is the case, who have been educated in this country to art have carried their talent to England and elsewhere, in point of fact that is not so much to be regretted, because you have given to those pupils an opportunity of employing their talents in the field that they naturally would select, and which is most advantageous for them that they would not otherwise have obtained. And therefore, though there may not be such large pecuniary rewards for them, you are doing a great national good, and giving a great advantage to your countrymen, in allowing them the opportunities which are possessed in other places of obtaining the elements of art culture. And allow me to say, that I attach more importance to elementary instruction—to the sound laying of the foundations of the knowledge of art—than I should do to success in the higher walks, because that success must depend on real genius, and those higher attainments which were—if he might say so, with great respect to this Society—almost beyond its scope. The object of the Society is to lay that foundation. If it be well laid, and if there should also exist in the individual those talents or that genius which are found, though rarely, yet through all nations, I believe, then, the highest results may be expected; but if we lay that foundation well, I believe we shall have discharged the duty that we owe to the country, and have done all that lies in us to promote what I believe is one of the most agreeable, and most useful, and most charming of pursuits— the pursuit of beauty as it is found in all those outward fabrics which we use and which surround us.

APPENDIX.

METEOROLOGICAL JOURNAL,

KEPT AT

The Royal Dublin Society's Botanic Garden, Glasnebin,

[HEIGHT ABOVE LEVEL OF SEA, 65 FEET.]

FROM

1st JANUARY, 1865.

DATE.	BAROMETER.	THERMOMETER.					WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Sunday, ...	29·910	32	32	31	35	26	W.	0	Many, . .	Broken, . .	. .	Frost, cloudy, changeable.
2 Monday, ...	29·300	38	38	36	40	27	S. W.	6	Few, . .	Do. . . .	·030	Rain A. M., clear P. M.
3 Tuesday, ...	29·600	38	40	37	40	29	S. W.	4	Many, . .	Do. . . .	·010	Frost A. M., overcast P. M.
4 Wednesday, . . .	29·820	44	45	43	49	38	S. W.	3	Do. . .	Do. . . .	. .	Breezy, and changeable.
5 Thursday, ...	29·680	42	44	42	46	39	S. E.	0	Do. . .	Do. . . .	·070	Showery day.
6 Friday, ...	30·120	40	41	41	45	34	W.	3	Few, . .	Do. . . .	. .	Clear, like frost.
7 Saturday, ...	30·050	44	45	44	46	35	S. W.	4	Many, . .	Do. . . .	. .	Dull, and changeable.
8 Sunday, ...	29·400	45	46	44	48	44	W.	0	Do. . .	Do. . .	·030	Showery A. M.
9 Monday, ...	29·430	44	45	43	47	39	W.	4	Do. . .	Do. . . .	·030	Do.
10 Tuesday, ...	29·480	45	46	45	49	37	S. W.	3	Do. . .	Do. . . .	. .	Fine, breezy day.
11 Wednesday, . . .	28·780	46	47	44	49	35	S. E.	4	Do. . .	Do. . . .	. .	Do.
12 Thursday, ...	28·700	48	48	46	49	34	S. W.	3	Do. . .	Do. . . .	·200	Changeable, like frost.
13 Friday, ...	28·636	36	37	35	40	31	S. E.	4	Do. . .	Do. . . .	·180	Snow showers frequent.
14 Saturday, ...	28·780	40	41	39	43	35	S. W.	4	Do. . .	Do. . . .	·020	Stormy day.
15 Sunday, ...	28·960	38	40	37	40	34	W.	3	Do. . .	Do. . . .	·060	Frost A. M., showery P. M.
16 Monday, ...	29·028	40	40	38	40	35	N. W.	4	Do. . .	Do. . . .	. .	Showery day.
17 Tuesday, ...	29·350	36	37	36	41	33	N. W.	6	Few, . .	Do. . . .	. .	Clear, and breezy, cold.
18 Wednesday, . . .	29·350	37	38	36	38	30	N. W.	0	Many, . .	Do. . . .	·030	Cold and changeable.
19 Thursday, ...	29·490	36	37	35	37	30	N.	4	Do. . .	Do. . . .	. .	Changeable A. M., clear P. M.
20 Friday, ...	29·580	33	36	35	38	25	W.	6	Few, . .	Do. . . .	. .	Clear and frosty.
21 Saturday, ...	29·550	32	33	32	35	17	W.	7	Many, . .	Do. . . .	. .	Do.
22 Sunday, ...	29·580	29	30	29	30	21	N. W.	0	Do. . .	Do . . .	. .	Dull, and foggy.
23 Monday, ...	29·580	30	32	31	32	21	N. W.	6	Few, . .	Do. . . .	. .	Clear, like frost.
24 Tuesday, ...	29·580	37	38	36	38	30	E.	5	Many, . .	Do. . . .	. .	Breezy, rather cold.
25 Wednesday, . . .	29·550	35	35	34	38	34	E.	6	Do. . .	Do. . . .	. .	Fine, calm day.
26 Thursday, ...	29·300	34	35	32	36	29	N. E.	0	Do. . .	Do. . . .	. .	Cold, snowy day.
27 Friday, ...	29·530	33	35	34	35	29	N. W.	6	None, . .	. . . .	·030	Clear, and frost.
28 Saturday, ...	29·820	34	34	33	36	19	W.	6	Few, . .	Do. . . .	. .	Do.
29 Sunday, ...	29·150	37	39	37	40	24	W.	0	Many, . .	Do. . . .	·140	Stormy, wet day.
30 Monday, ...	29·780	45	47	44	48	40	W.	4	Do. . .	Do. . . .	·560	Fine, mild day.
31 Tuesday, ...	29·730	42	43	41	45	39	S. W.	0	Do. . .	Do. . . .	·100	Stormy, wet day.
								105	Total Amount of Rain,		1·490 inches.	

FEBRUARY, 1865.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Wednesday, . . .	28·730	48	49	48	49	40	S. W.	6	Many, . .	Broken, . .	·040	Fine, mild day.
2 Thursday, ...	28·940	45	47	46	48	42	W.	6	Do. . .	Do. . . .	·010	Do.
3 Friday, ...	29·350	45	46	45	47	40	E.	4	Do. . .	Do. . . .	·020	Dull, and changeable.
4 Saturday, ...	29·350	40	41	39	43	31	S. E.	0	Do. . .	Do. . . .	·480	Stormy, wet day.
5 Sunday, ...	29·630	40	41	39	42	37	S. E.	0	Do. . .	Do. . . .	·240	Dull, and showery.
6 Monday, ...	29·490	42	42	40	44	39	S. E.	0	Do. . .	Do. . . .	·050	Do.
7 Tuesday, ...	29·730	42	44	42	46	39	N. E.	0	Do. . .	Do. . . .	. .	Dull, and cloudy.
8 Wednesday, . . .	30·010	40	41	40	43	38	E.	0	Do. . .	Do. . . .	·200	Do.
9 Thursday, ...	30·360	47	48	37	39	35	S. E.	4	Do. . .	Do. . . .	. .	Breezy, and very cold.
10 Friday, ...	30·450	46	41	40	42	30	S. E.	4	Do. . .	Do. . . .	. .	Fine, mild day.
11 Saturday, ...	30·320	41	41	40	42	37	S. E.	2	Do. . .	Do. . . .	·150	Rain A. M., changeable P. M.
12 Sunday, ...	30·150	37	37	36	40	35	E.	0	Do. . .	Do. . . .	·020	Breezy, and changeable
13 Monday, ...	30·180	37	38	37	39	32	N. E.	0	Do. . .	Do. . . .	·010	Snowy showers, very cold.
14 Tuesday, ...	30·100	35	37	36	38	32	E.	3	Do. . .	Do. . . .	. .	Breezy, and changeable.
15 Wednesday, . . .	30·970	36	37	36	57	26	W.	6	Do. . .	Do. . . .	. .	Very fine day.
16 Thursday, ...	29·220	37	38	36	38	28	N. W.	4	Do. . .	Do. . . .	. .	Cloudy A. M., fine P. M.
17 Friday, ...	29·180	36	38	36	38	26	W.	6	Do. . .	Do. . . .	·020	Snow A. M., clear P. M.
18 Saturday, ...	29·180	45	48	46	48	32	S. W.	0	Do. . .	Do. . . .	·120	Frost A. M., stormy and showery P. M.
19 Sunday, ...	29·700	35	36	35	36	32	N. W.	0	Do. . .	Do. . . .	·130	Snow, and very stormy.
20 Monday, ...	30·220	37	40	38	40	28	N. W.	4	Few, . .	Do. . . .	·010	Fine, clear day.
21 Tuesday, ...	30·150	51	52	51	52	31	W.	3	Do. . .	Do. . . .	. .	Fine, mild day.
22 Wednesday, . . .	30·180	48	50	49	50	45	S. W.	0	Many, . .	Do. . . .	. .	Gloomy, and overcast.
23 Thursday, ...	30·020	50	51	50	51	48	S. W.	0	Do. . .	Do. . . .	. .	Do.
24 Friday, ...	29·000	50	50	49	51	44	W.	5	Do. . .	Do. . . .	. .	Fine, mild day.
25 Saturday, ...	29·800	47	48	46	49	37	S. W.	4	Do. . .	Do. . . .	. .	Do.
26 Sunday, ...	29·850	47	49	47	50	38	W.	4	Do. . .	Do. . . .	·220	Rain A. M., fine P. M.
27 Monday, ...	29·830	46	49	47	50	30	S. W.	3	Do. . .	Do. . . .	. .	Frost A. M., overcast P. M.
28 Tuesday, ...	29·330	45	45	43	38	41	N. W.	3	Do. . .	Do. . .	·110	Fair A. M., heavy shower P. M.
								71	Total Amount of Rain.		1·700 Inches.	

MARCH, 18[illegible]

DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	Temp.	THERMOMETER. Dry.	Wet.	Max.	Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Wednesday, . .	29·700	48	49	48	50	39	W.	5	Many, . .	Broken, . .	·030	Fine, breezy day.
2 Thursday, . . .	30·030	47	49	47	50	40	W.	3	Do. . .	Do. . . .	·010	Do.
3 Friday, ...	30·270	47	47	46	50	32	W.	6	Do. . .	Do. . . .	. .	Do.
4 Saturday, . . .	29·600	41	42	40	42	39	W.	0	Do. . .	Do. . . .	·170	Showery day.
5 Sunday, ...	29·490	42	44	42	45	35	W.	6	Do. . .	Do. . . .	. .	Fine, breezy day.
6 Monday, ...	29·400	45	45	43	46	29	N. W.	4	Do. . .	Do. . . .	·010	Frost A. M., showery P. M.
7 Tuesday, ...	29·500	40	40	39	41	30	S. W.	3	Do. . .	Do. . . .	·020	Frost A. M., sleety showers P. M.
8 Wednesday, . .	29·950	40	40	39	41	30	.	4	Do. . .	Do. . . .	·210	Fine, breezy day.
9 Thursday, . . .	30·060	44	45	44	46	30	N. W.	6	Few, . .	Do. . . .	. .	Fine, clear day.
10 Friday, ...	30·000	45	46	45	46	32	N. W.	4	Many, . .	Do. . . .	. .	Do.
11 Saturday, . . .	29·990	46	47	46	47	31	N. W.	3	Do. . .	Do. . . .	. .	Fine, mild day.
12 Sunday, ...	30·010	45	46	45	47	37	S. E.	4	Do. . .	Do. . . .	·070	Do.
13 Monday, ...	30·100	44	44	43	46	38	E.	6	Do. . .	Do. . . .	. .	Strong breeze, changeable.
14 Tuesday, . . .	29·940	40	41	39	43	35	E.	0	Do. . .	Do. . . .	. .	Breezy, and changeable.
15 Wednesday, . .	29·800	41	43	42	45	32	N. E.	4	Do. . .	Do. . . .	. .	Cloudy, and changeable.
16 Thursday, . . .	29·750	46	47	45	50	34	S. E.	6	Do. . .	Do. . . .	. .	Do.
17 Friday, ...	29·700	41	42	40	44	38	S. E.	6	Do. . .	Do. . . .	. .	Strong breeze, changeable.
18 Saturday, . . .	29·700	40	42	40	43	37	S. E.	0	Do. . .	Do. . . .	. .	Very stormy, like rain.
19 Sunday, ...	29·750	37	37	36	39	34	S. E.	0	Do. . .	Do. . . .	. .	Do.
20 Monday, ...	29·950	39	40	39	40	32	N. E.	6	None, . .	. . . . . .	. .	Do.
21 Tuesday, . . .	29·950	35	37	36	37	30	N. E.	2	Many, . .	Do. . . .	. .	Breezy, and very cold.
22 Wednesday, . .	29·980	40	40	39	42	30	N.	6	Do. . .	Do. . . .	. .	Do.
23 Thursday, . . .	29·980	43	44	43	44	30	N. E	7	None, . .	. . . . . .	. .	Fine, clear day.
24 Friday, ...	29·620	42	43	42	44	30	N. E.	4	Many, . .	Do. . . .	. .	Cold, and changeable.
25 Saturday, . . .	29·500	44	46	44	46	35	W.	0	Do. . .	Do. . . .	·140	Cold, wet day.
26 Sunday, ...	29·780	42	45	44	45	37	N. W.	4	Do. . .	Do. . . .	·080	Fine, mild day.
27 Monday, ...	30·050	42	43	42	44	25	W.	6	Do. . .	Do. . . .	·040	Snow A. M , showery P. M.
28 Tuesday, ...	29·900	43	44	43	45	35	S.	0	Do. . .	Do. . . .	·350	Mild, and showery.
29 Wednesday, . .	30·020	19	51	50	51	41	N. W.	6	Do. . .	Do. . . .	·020	Fine, mild day.
30 Thursday, . . .	30·170	52	54	53	54	37	S. W.	4	Do. . .	Do. . . .	. .	Cloudy, and changeable.
31 Friday, ...	30·000	57	59	57	59	45	S. W.	7	Do. . .	Do. . . .	. .	Fine, breezy day.
								126	Total Amount of Rain,		1·150	inches.

APRIL, 1865.

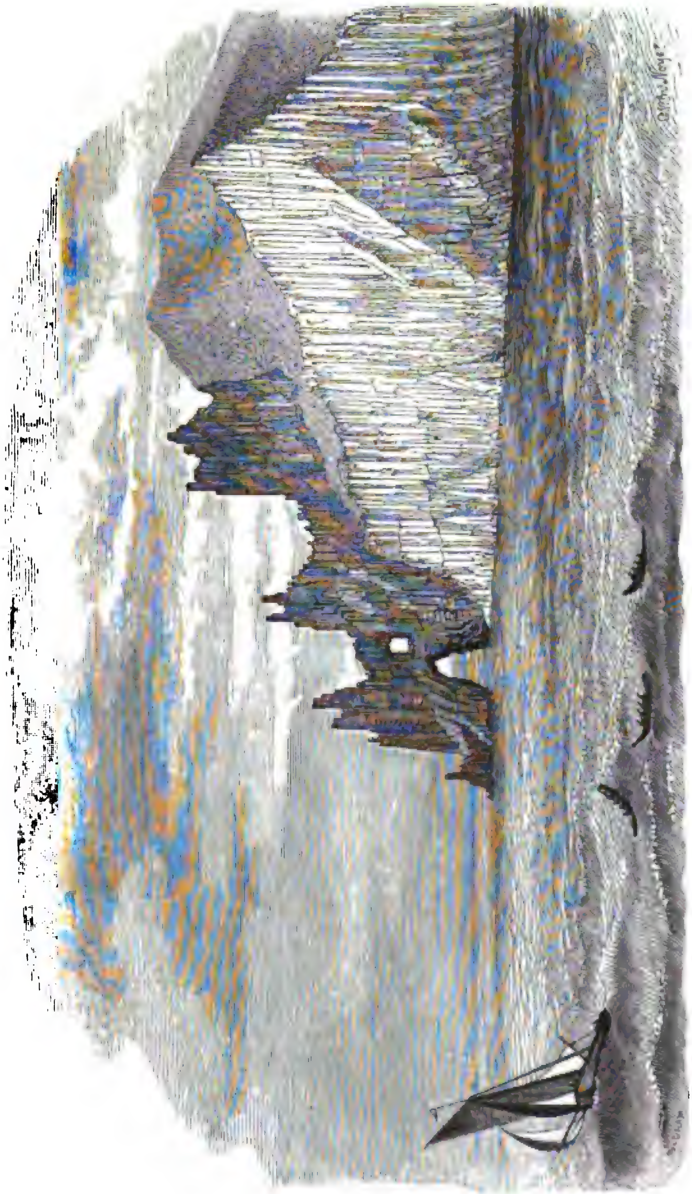
DATE. Day, At 4 o'Clock, P. M.	BAROMETER. Height.	THERMOMETER. Temp.	Dry.	Wet.	Max.	Min.	WIND. Direction.	HOURS OF SUNSHINE.	CLOUD. Amount.	Form.	RAIN.	WEATHER, AND GENERAL REMARKS.
1 Saturday, ...	29·990	50	52	51	52	35	W.	8	Many, . .	Broken, . .	. .	Fine, breezy day.
2 Sunday, ...	29·730	47	48	47	49	35	W.	8	Do. . .	Do. . . .	. .	Do.
3 Monday, ...	29·850	49	52	51	52	41	N. W.	3	Do. . .	Do . . .	. .	Showery A. M., fine P. M.
4 Tuesday, ...	29·900	49	51	50	52	43	W.	4	Do. . .	Do. . . .	·100	Fine mild day.
5 Wednesday, . . .	30·130	59	62	61	62	45	S. W.	6	Do. . .	Do. . . .	·030	Do.
6 Thursday, ...	30·180	54	56	54	56	47	S. W.	4	Do. . .	Do. . . .	·040	Do.
7 Friday, ...	30·180	55	56	55	57	46	S.	5	Do. . .	Do. . . .	. .	Changeable, like rain.
8 Saturday, . . .	30·056	54	55	54	56	41	S. W.	4	Do. . .	Do. . . .	. .	Do.
9 Sunday, ...	30·070	53	55	54	56	39	W.	6	Do. . .	Do. . . .	. .	Fine, breezy day.
10 Monday, ...	30·090	51	53	52	54	42	S. W.	6	Do. . .	Do. . . .	. .	Do.
11 Tuesday, ...	30·150	54	55	54	57	38	E.	8	Do. . .	Do. . . .	. .	Do.
12 Wednesday, . . .	30·150	51	52	51	54	37	E.	8	Few, . .	Do. . . .	. .	Breezy, fine sunshiny day.
13 Thursday, ...	30·080	53	55	54	56	39	N. E.	6	Do. . .	Do. . . .	. .	Breezy, and changeable.
14 Friday, ...	30·050	52	54	52	56	40	S. W.	5	Many, . .	Do. . . .	. .	Changeable, like rain P. M.
15 Saturday, ...	30·100	51	52	51	54	38	S. E.	6	Do. . .	Do. . . .	. .	Fine, breezy day.
16 Sunday, ...	29·980	53	58	58	55	36	N. E.	5	Do. . .	Do. . . .	. .	Breezy, and changeable.
17 Monday, ...	29·830	54	55	54	56	33	S. E.	0	Do. . .	Do. . . .	·160	Rain A. M., cloudy P. M.
18 Tuesday, ...	29·998	55	56	55	59	46	N. W.	0	Do. . .	Do. . . .	·180	Showery day.
19 Wednesday, . . .	30·150	46	48	47	48	43	N. E.	0	Do. . .	Do. . . .	·560	Rain A. M., cloudy P. M.
20 Thursday, ...	30·280	56	58	57	59	45	N. E.	6	Few, . .	Do. . . .	·030	Cloudy A. M., clear P. M.
21 Friday, ...	30·210	54	55	54	56	40	E.	8	Do. . .	Do. . . .	. .	Fine, breezy day.
22 Saturday, ...	30·150	59	62	61	62	40	E.	9	None, . .	. . . . . .	. .	Do.
23 Sunday, ...	30·200	58	62	61	63	37	E.	10	Do. . .	Do. . . .	. .	Do.
24 Monday, ...	30·250	59	63	62	68	48	S. E.	10	Do. . .	Do. . . .	. .	Fine, clear day.
25 Tuesday, ...	30·200	62	65	64	65	35	S. E.	10	Do. . .	Do. . . .	. .	Do.
26 Wednesday, . . .	29·180	58	62	60	62	41	S. E.	6	Few, . .	Do. . . .	. .	Cloudy A. M., clear P. M.
27 Thursday, . . .	30·070	54	57	55	60	46	S. E.	9	Many, . .	Do. . . .	. .	Fine, but changeable.
28 Friday, ...	30·030	54	55	54	56	38	N. E.	9	Few, . .	Do. . . .	. .	Do.
29 Saturday, ...	30·000	50	54	52	57	47	E.	10	Do. . .	Do. . . .	. .	Do.
30 Sunday, ...	29·900	54	56	54	56	40	E.	8	Many, . .	Do. . . .	. .	Do.
								187	Total Amount of Rain,		1·100 Inches	

MAY, 18[illegible].

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day. At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Monday, ...	29·700	57	60	58	61	46	W.	10	Many, . .	Broken, . .	·140	Heavy showers during day.
2 Tuesday, ...	29·630	57	59	57	60	48	S. E.	0	Do. . .	Do. . . .	·030	Showery day.
3 Wednesday, . . .	29·480	53	54	52	55	43	S.	6	Do. . .	Do. . . .	·020	Dull, and gloomy.
4 Thursday, . . .	29·450	50	52	50	54	44	S. E.	6	Do. . .	Do. . . .	·040	Do.
5 Friday, ...	29·490	52	56	54	56	41	S. E.	3	Do. . .	Do. . . .	·620	Very wet day.
6 Saturday, ...	29·850	62	65	64	65	47	S. W.	10	Do. . .	Do. . . .	. .	Fine, breezy day.
7 Sunday, ...	29·980	55	57	56	58	42	N. E.	8	Do. . .	Do. . . .	. .	Do.
8 Monday, ...	29·980	62	65	64	65	44	N. E.	10	None, . .	. . . .	. .	Do.
9 Tuesday, ...	29·730	53	55	53	57	45	N. E.	4	Many, . .	Do. . . .	. .	Dull, and gloomy.
10 Wednesday, . . .	29·063	46	49	47	50	43	N. E.	0	Do. . .	Do. . . .	·180	Gloomy, showery day.
11 Thursday, . . .	29·730	49	52	50	52	40	N. W.	6	Do. . .	Do. . . .	·150	Showery day.
12 Friday, ...	29·860	45	46	45	48	42	N. E.	0	Do. . .	Do. . . .	·360	Do.
13 Saturday, ...	29·840	49	53	50	53	42	E.	0	Do. . .	Do. . . .	·130	Dull, and gloomy.
14 Sunday, ...	29·820	47	49	47	50	41	S. W.	0	Do. . .	Do. . . .	. .	Do.
15 Monday, ...	29·510	51	54	52	54	43	W.	8	Do. . .	Do. . . .	·110	Hail showers A. M., fair P. M.
16 Tuesday, ...	29·450	54	56	54	56	41	S. W.	8	Do. . .	Do. . . .	. .	Very stormy P. M.
17 Wednesday, . . .	29·880	59	61	60	62	46	W.	9	Do. . .	Do. . . .	. .	Strong breeze, fine day.
18 Thursday, . . .	30·100	60	66	64	66	43	S. W.	0	Do. . .	Do. . . .	. .	Do.
19 Friday, ...	30·150	60	64	63	65	50	S. W.	8	Do. . .	Do. . . .	. .	Do.
20 Saturday, ...	30·250	60	61	60	61	52	E.	6	Do. . .	Do. . . .	. .	Do.
21 Sunday, ...	29·950	63	66	65	66	54	N. E.	10	Do. . .	Do. . . .	. .	Light rain A. M., fine P. M.
22 Monday, ...	29·870	61	63	62	63	55	E.	10	Do. . .	Do. . . .	. .	Fine, breezy day.
23 Tuesday, ...	29·930	65	68	67	68	58	S. E.	10	Few, . .	Do. . . .	. .	Fine, sunshiny day.
24 Wednesday, . .	29·990	63	69	68	69	52	S. W.	10	Do. . .	Do. . . .	. .	Do.
25 Thursday, . . .	30·000	57	60	59	62	45	S. E.	3	Many, . .	Do. . . .	. .	Dull, and changeable.
26 Friday, ...	29·780	57	60	58	61	46	S. W.	0	Do. . .	Do. . . .	·110	Showery day.
27 Saturday, . . .	29·600	56	58	56	58	43	E.	4	Do. . .	Do. . . .	·020	Overcast P. M.
28 Sunday, ...	29·700	61	64	62	65	49	S. W.	0	Do. . .	Do. . . .	·020	Changeable A. M., rain P. M.
29 Monday, ...	29·450	57	59	57	59	48	S.	0	Do. . .	Do. . . .	·900	Very wet day.
30 Tuesday, ...	29·650	56	57	56	58	45	S. E.	0	Do. . .	Do. . . .	·190	Showery day.
31 Wednesday, . .	29·900	55	58	56	60	47	E.	6	Do. . .	Do. . . .	·100	Fine, breezy day.
								155	Total Amount of Rain,		3·120 inches.	

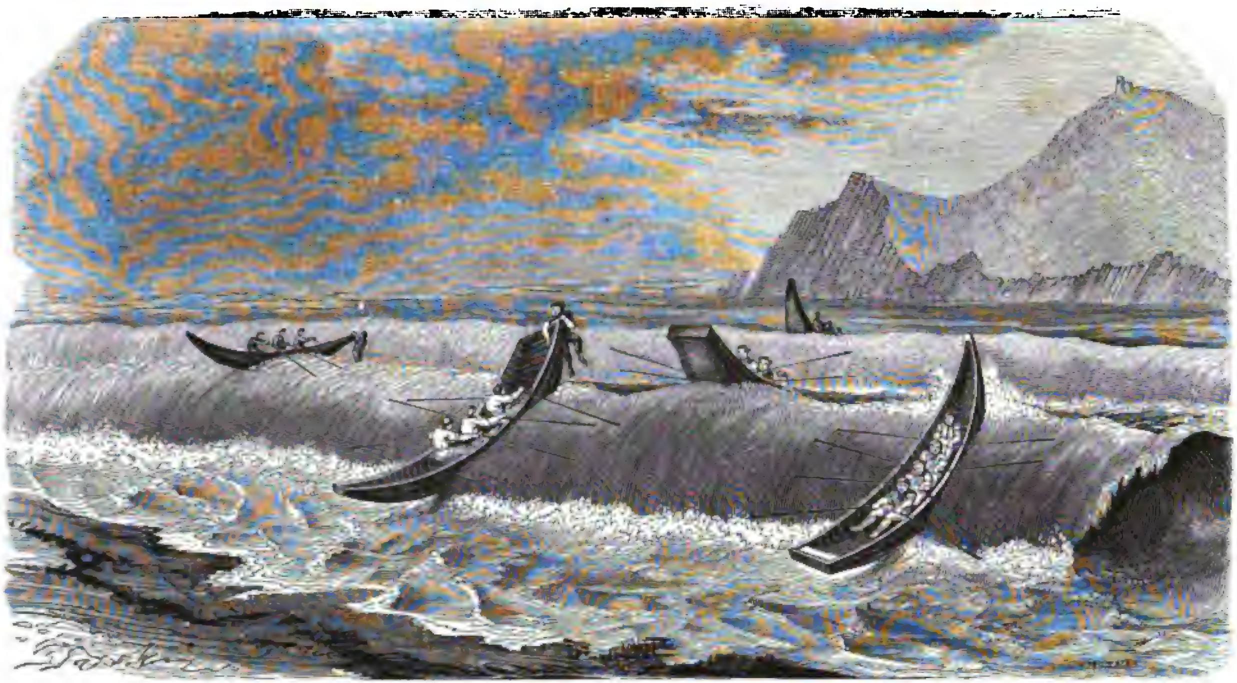
JUNE, 1865.

DATE.	BAROMETER.		THERMOMETER.				WIND.	HOURS OF SUNSHINE.	CLOUD.		RAIN.	WEATHER, AND GENERAL REMARKS.
Day, At 4 o'Clock, P. M.	Height.	Temp.	Dry.	Wet.	Max.	Min.	Direction.		Amount.	Form.		
1 Thursday,	29·720	53	54	52	55	41	S. E.	8	Many,	Broken,	·820	Very wet P. M.
2 Friday,	29·630	53	56	54	53	50	N. E.	0	Do.	Do.	·040	Dull, and gloomy.
3 Saturday,	30·000	61	64	62	64	50	W.	8	Do.	Do.	..	Fine, breezy day.
4 Sunday,	30·240	61	64	62	65	43	N. W.	6	Do.	Do.	..	Do.
5 Monday,	30·290	72	75	74	76	57	S. W.	10	Do.	Do.	..	Very warm day.
6 Tuesday,	30·330	71	74	73	74	59	W.	10	Do.	Do.	..	Fine, breezy day.
7 Wednesday,	30·420	63	65	64	65	50	E.	10	None,	......	..	Fine, sunshiny day.
8 Thursday,	30·420	77	79	78	79	50	S. W.	10	Do.	Do.	..	Very warm day.
9 Friday,	30·390	66	69	68	70	59	E.	10	Do.	Do.	..	Do.
10 Saturday,	30·230	75	78	76	78	57	N. W.	10	Do.	Do.	..	Do.
11 Sunday,	30·330	62	64	62	66	56	S. W.	10	Many,	Do.	..	Fine, mild day.
12 Monday,	30·290	62	64	63	66	54	N. E.	8	Do.	Do.	..	Do.
13 Tuesday,	30·240	69	71	70	71	49	N. E.	10	Do.	Do.	..	Very warm day.
14 Wednesday,	30·339	60	63	62	65	50	W.	9	Do.	Do.	..	Fine, breezy day.
15 Thursday,	30·420	64	66	64	68	57	W.	10	Do.	Do.	..	Do.
16 Friday,	30·420	73	75	74	75	56	S. W.	10	Do.	Do.	..	Very warm day.
17 Saturday,	30·280	69	71	70	71	50	W.	10	Do.	Do.	..	Do.
18 Sunday,	30·350	73	75	74	76	47	N. W.	10	Few,	Do.	..	Do.
19 Monday,	30·250	71	74	73	75	48	S. E.	10	Do.	Do.	..	Do.
20 Tuesday,	30·250	69	72	70	74	46	N. E.	10	Do.	Do.	..	Fine, breezy day.
21 Wednesday,	30·200	76	79	78	80	49	N. W.	10	Do.	Do.	..	Do.
22 Thursday,	30·000	70	74	72	76	45	W.	10	Many,	Do.	..	Clear A. M., changeable P. M.
23 Friday,	30·120	71	74	72	75	46	S. W.	9	Do.	Do.	·090	Heavy showers P. M.
24 Saturday,	30·140	68	71	69	71	47	N. W	10	Do.	Do.	..	Strong breeze, fine day.
25 Sunday,	30·150	67	70	69	72	49	S. W.	10	Do.	Do.	..	Fine day.
26 Monday,	30·100	69	71	70	74	50	N. W.	10	Do.	Do.	..	Changeable P. M.
27 Tuesday,	30·120	66	68	67	68	56	S. E.	10	Do.	Do.	..	Do.
28 Wednesday,	30·346	67	70	68	70	59	S. E.	10	Do.	Do.	·010	Rain A. M., fine P. M.
29 Thursday,	29·450	64	68	66	68	58	S. E.	10	Do.	Do.	·010	Light rain A. M.
30 Friday,	29·620	62	65	63	65	52	N. E.	10	Do.	Do.	·280	Do.
								173	Total Amount of Rain,		0·750	Inches.



No. 2.—TO ILLUSTRATE MR. ANDREWS' PAPER ON THE SEA FISHERIES OF IRELAND.

INNISNABROE FROM THE OUTER SOUND, THE COURSE FROM THE TEARAGHT ROCK BEARING BY COMPASS S. E. BY S.



No. 3.—TO ILLUSTRATE MR. ANDREWS' PAPER ON THE SEA FISHERIES OF IRELAND.

CORRACHS BEACHING IN SMERWICK BAY, COAST OF KERRY, BALLYDAVID HEAD, EASTERN ENTRANCE OF THE BAY.

Royal Dublin Society—continued.

II.—Departments of the Society.

1. *Agriculture.*

a. The Annual Spring Show of Cattle, Poultry, and Implements, is held on ...esday in Easter Week.

b. The Christmas Show of Fat Stock and Farm and Dairy Produce is held the Third Week of December.

c. Chemical Analyses of Agricultural Produce, Soils, Manures, &c., are per-...med in the Laboratory, under the superintendence of the Professor of Agricul-...re, according to a fixed scale of moderate charges.

d. The Agricultural Museum open daily (Sundays excepted) from 11 to 4 ...lock.

III.—Botanic Gardens and Botanical Museum, Glasnevin.

Open from 12 to 5 o'Clock daily on Mondays, Wednesdays, and Fridays; and ... Saturdays from 2 o'clock, free. On Tuesdays and Thursdays at 6*d.* for Adults, ...d 3*d.* for Children. On Sundays from 2½ to sunset, free.

Persons producing Members' Orders are admitted free at any time.

IV.—Museum of Natural History.

Open from 12 to 3 o'Clock on Mondays, Wednesdays, and Fridays, *free* to the ...ublic; and on Tuesdays and Thursdays at 6*d.* for Adults, and 3*d.* for Children. ...ersons producing Members' Orders are admitted free at any time. [At present ...n process of arrangement.]

V.—School of Art.

Instruction in Elementary Drawing, Painting, and Modelling, is given on every Week-day, except Saturday, during the Session, from October to July, inclusive. Evening Courses for the Working Classes.

The Session commences on October 1st, and terminates on the 31st July in each year.

An Examination takes place once a year in the School.

Prospectuses to be had on application.

VI.—Library,

Which contains about 30,000 volumes, is open daily (Sundays excepted) from 11 to 5 o'Clock; and on Mondays, Wednesdays, and Fridays, from 7½ to 9½ o'Clock, P. M.

Any person having a recommendation from a Member is admitted to read in the Library.

Members have the privilege of borrowing a limited number of books.

The Conversation Room, which is provided with a large collection of Periodicals, and in which all the recently purchased Works remain for one Month, is set apart for the exclusive use of the Members.

VII.—Lectures.

Courses of Lectures on Botany, Chemistry, both General and Agricultural, Natural Philosophy, Zoology, Geology, Anatomy in connexion with the Fine Arts, are successively delivered each year, from October to June, inclusive. Seats are specially provided for Members and their families in the Lecture Theatre.

THE JOURNAL OF THE ROYAL DUBLIN SOCIETY is sent in Exchange for the Transactions and Publications of the following Institutions, &c.:—

Royal Acad. of Sciences, Amsterdam.
Natural History Society, Belfast.
Chemico-Agricultural Society of Ulster, Belfast.
Royal Academy of Sciences, Berlin.
German Geological Society, Berlin.
Imperial Acad. of Sciences, Bordeaux.
American Academy, Boston.
Natural History Society, Boston.
Institution for the Advancement of Science, Liter., and the Arts, Bristol.
Academy of Sciences, Brussels.
Geological Museum, Calcutta.
Mechanics' Institute, Clonmel.
Philosophical Society, Cambridge.
Royal Society of Science, Copenhagen.
Royal Institution, Cork.
Royal Cornwall Polytechnic Society, Falmouth.
Academy of Sciences, Dijon.
Royal Irish Academy, Dublin.
Trinity College Library, Dublin.
Royal Geological Society of Ireland.
Dublin Natural History Society.
Geological Survey of Ireland, Dublin.
Royal College of Surgeons, Dublin.
University Philos. Society, T. C. D.
University Zoological and Botanical Association, T. C. D.
Statistical Society, Dublin.
Museum of Irish Industry, Dublin.
Royal Society, Edinburgh.
Highland Agricul. Society, Edinburgh.
Wernerian Society, Edinburgh.
Society of Arts, Edinburgh.
Advocates' Library, Edinburgh.
Die Königlich Sachsischen Gesellschaft der Wissenschaften zu Leipsig.
Society of Physics and Natural History, Florence.
Society of Physics, Genoa.
Société Vaudoise des Sc. Nat., Lausanne.
Geological and Polytechnic Society of the West Riding of Yorkshire, Leeds.
Philosoph and Literary Society, Leeds.
Historic Society of Lancashire and Cheshire, Liverpool.
Literary and Philos. Society, Liverpool.
British Archæological Society, London.
Royal College of Surgeons, London.
Royal Society, London.
Geological Society, London.
Linnean Society, London.
Royal Geographical Society, London.
Civil Engineers' Institute, London.
Royal Asiatic Society, London.
Zoological Society, London.
Royal Agricultural Society of England.
Statistical Society, London.
Pathological Society, London.
Royal Astronomical Society, London.
Department of Science and Art, London.
Great Seal Patent Office, London.
Society of Arts, London.
Geological Survey, London.
Royal Institution, London.
London and Middlesex Archæol. Society.
British Museum.
King's Inns Library, Dublin.
National Association for the Promotion

La Société Imperiale d'Agriculture, d'Histoire Naturelle, et des Arts Utiles, Lyons.
Société Linneen de Lyons.
Academie Imperiale de Lyons.
Literary and Philosophical Society of Manchester.
The Royal Institution, Manchester.
Geological Society, Manchester.
Somersetshire Archæological and Natural History Society.
Northampton Architectural Society.
Philosophical Institute of Victoria, Melbourne.
Public Library, Melbourne.
Imperial Institute of Science, Milan.
State Survey and Univ., Missouri, U.S.
Academy of Science of St. Louis, Missouri, U. S. A.
Imperial Institute of Science, Modena
Royal Academy of Science, Munich (2 copies.)
Editors of Silliman's Journal of Science and Art, New Haven.
Bodleian Library, Oxford.
Ashmolean Society, Oxford.
Ecole Polytechnique, Paris.
Geological Society, Paris.
L'Ecole Imp. des Mines, Paris.
L'Academie des Sciences de l'Institu Imperial de France, Paris.
Jardin des Plantes Bibliotheque, Paris.
Sociétés Savantes de la France et de l'Etrangés, Paris.
American Philosophical Society, Philadelphia, U. S.
Natural History Society, Philadelphia.
Plymouth Institution and Devon and Cornwall Natural History Society, Plymouth.
Literary and Historical Society, Quebec
Academy of Science, Rouen.
Imperial Academy, St. Petersburgh.
Central Physical Observatory of Russia St. Petersburgh.
Royal Academy of Science, Stockholm.
Société des Sciences Naturelles de Strasbourg.
Canadian Institute, Toronto.
University College, Toronto.
Academy of Sciences, Toulouse.
Royal Academy, Turin.
Industrial Museum, Turin.
Michigan State Agricultural Society, Lausing, Michigan, U. S.
Wisconsin State Agricultural Society, Wisconsin.
Royal Soc. of Sciences, Upsala, Sweden
Venetian Society of Science, Literature and the Arts, Venice.
Verein für Vaterländische Naturkunde Stuttgart.
Imperial Academy of Sciences, Vienna
W. Haidinger, of Vienna, as Editor of the "Jahrbuch der K. K. Geologische Reichsanstalt."
Smithsonian Institute, Washington, U.S.
Imp. Reg. Instituto Veneto de Scienze &c., Venice.
Deutsche Geologische Gesellschaft